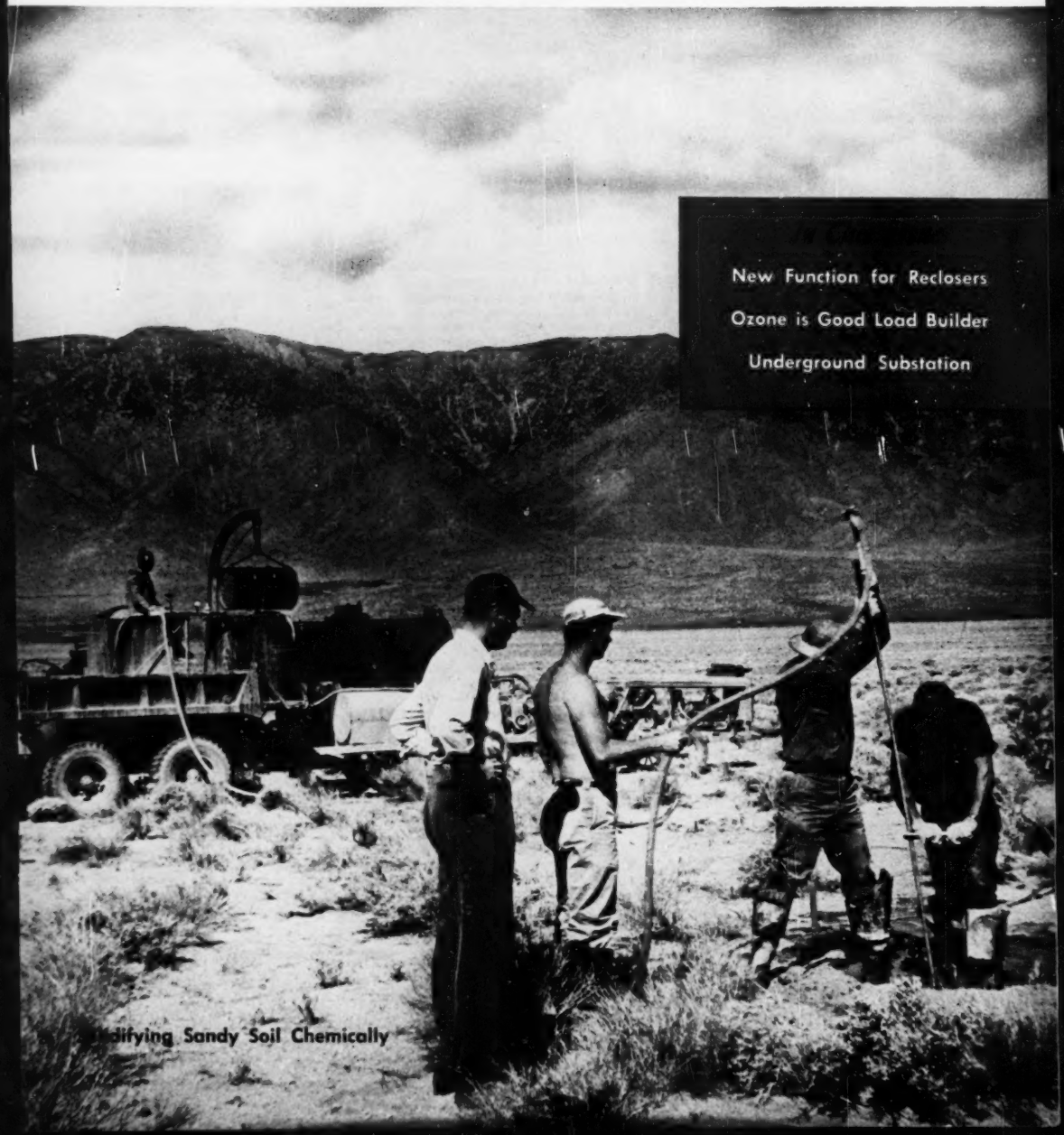
JANUARY 15, 1951

# Electrical World

A McGRAW-HILL PUBLICATION



New Function for Reclosers

Ozone is Good Load Builder

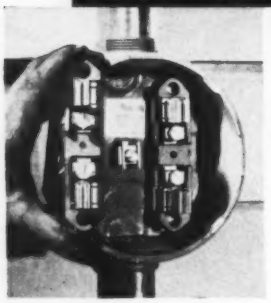
Underground Substation

...difying Sandy Soil Chemically

# The Murray METER SOCKET

## *will save you money* because it is fully *Adaptable*

**HERE'S HOW IT WORKS . . . Minor on-the-job adjustments convert the Murray Meter Socket**



1

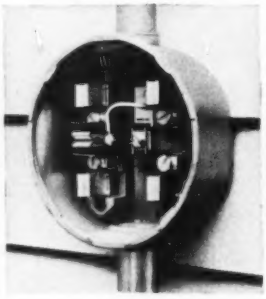
Here is the Murray Meter Socket with jaws in a vertical position. To make conversions, simply remove mounting blocks by taking two screws, top and bottom, out of each.

2

Conversions are quickly and easily made at the back of each block. The jaws may be turned to a horizontal position. With the jaws in a vertical or horizontal position, the solderless connectors can be swung out into the gutter for bussing.

3

This picture shows the jaws in a horizontal position, the solderless connectors swung out. Note the *depth* of the socket and the sturdiness of its one piece steel construction.



4

Some applications in the field require the use of a fifth jaw. Such a fifth jaw is available with the Murray Meter Socket.

The Murray Meter Socket is quickly and easily adaptable to a variety of situations met in the field. A minor adjustment converts the socket on the job to the type required. This versatility can save power companies money every day. With the Murray Meter Socket there is no need to stock and carry a number of different types to the job.
The Murray Meter Socket is all types in one.

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INTERLOCKED SEAM ANCHORS HUBS TO SOCKET

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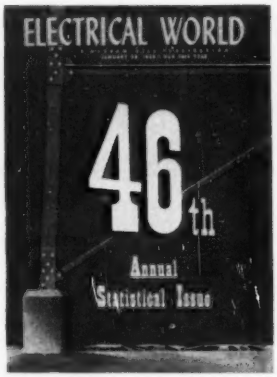
Current Limiting Reactors · Crows'nest Aerial Ladders

## THE STATISTICAL ISSUE

The first statistical report on the business of generating and delivering electric energy in America was made in 1902 by the U. S. Census Bureau. After that the census figures appeared at 5-year intervals for 35 years. But five years was a long time between reports—a long time to wait for the industry's facts and figures. So Electrical World stepped into the breach in 1904. For the next 20 years we were the only agency to gather and publish annual statistics on electric utility operations. The National Electric Light Association started compiling yearly figures in 1926 by organizing what is now the statistical department of EEI.

Electrical World's forthcoming issue is the 47th Statistical Number. For the third year the issue will include "A Look Ahead"—a conscientious estimate for the coming year.




**LAST YEAR'S issue was the 46th**

This year's report is based on returns from utilities representing 84% of the nation's electrical customers and more than 90% of the installed capacity.

We've added a few items which we think will make the compilation more definitive and useful: You'll see that we've devoted two pages to labor, a new chart to customers and an extra page to the budget.

We've also tried to separate the data into the agencies concerned, such as PUD's, municipals, REA cooperatives and federal agencies.

As every industry figure shoots higher, the gathering, compiling and publishing of them becomes an increasingly useful and important job.

THE EDITORS

# Electrical World

**Published for 77 years for those engaged in the business of generating, transmitting, distributing or applying electric power**

**Vol. 135 No. 3** **January 15, 1951**

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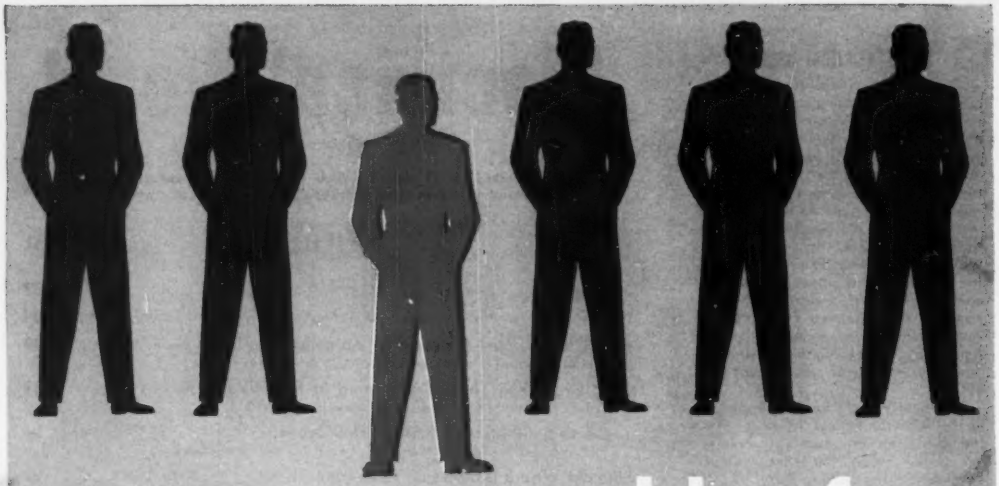

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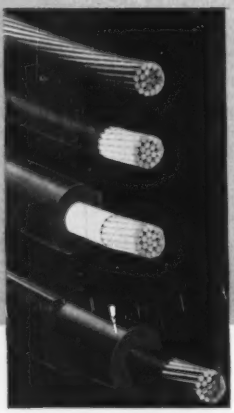

*He's the one man out of every six at Okonite who is engaged in testing and inspection*...a remarkably high ratio. In a sense, he's your inspector – for he's your assurance that the Okonite cable you buy is as nearly perfect electrically as can be made.

For example, in the manufacture of Okolite-Okoprene cable, here are a few specific instances of how these experienced testing and inspecting men at Okonite protect your cable investment:

... Immediately after mixing, a sample of every individual batch of insulating compound is vulcanized and laboratory tested to check formulation and required characteristics, before any further processing can take place.

... A recently-developed technique permits electrical testing of every foot of the insulating compound strips *before application* to the conductors. This is another advantage of the Okonite strip-insulating method, used in making all Okolite-Okoprene cables.

... Every foot of Okolite-Okoprene is subjected to super-voltage a-c and d-c tests to check out even the tiniest concealed imperfection. These super-voltage tests are the most severe in the entire cable industry.

These are just a few of the complete testing and inspection steps taken at Okonite that assure you the extra circuit protection and long life you expect when you buy Okolite-Okoprene cables. Write for Bulletin EW-2009 which contains detailed information about Okonite's unique manufacturing methods and policies. The Okonite Company, Passaic, N. J.

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# LONG on LIFE

Low in cost, long on life. That's the simple story of ANHYDROPRENE Wires. And those are the reasons why it pays to remember ANHYDROPRENE whenever you're planning new transmission and distribution systems, or are preparing to rewire those already in use.

ANHYDROPRENE Wires consist only of conductor, the famous Anhydrex insulation, and a thin, but tough, neoprene jacket. On some of the large sizes a tape is inserted between insulation and jacket. This simple construction establishes low purchase cost and produces a small-diameter, lightweight wire that's inexpensive to install.

ANHYDROPRENE construction also provides sound electrical and physical properties. There's the low water absorption and high dielectric strength of Anhydrex insulation. There's the resistance to abrasion, acids, corrosive chemicals, light and flame of the neoprene jacket. At 8000 volts and under, ANHYDROPRENE Wires can be operated at copper temperatures as high as 75°C. These features assure trouble-free service year after year, even under unfavorable conditions. And long, trouble-free service means low installation costs and infrequent replacements.

ANHYDROPRENE Wires can be racked on walls and installed underground in ducts. You'll find them especially dependable for plant and shop wiring; for instrument wiring; as underground primaries, transformer leads, and pole line risers; and in signal and control circuits.

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OUTDOOR CURRENT, for accurate heavy duty metering; Type KO — up to 15 kv — 10 to 800 amperes.

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Whether your need is for instrument transformers, current or potential transformers, or metering outfits, you will profit three ways when you call on the Allis-Chalmers source of supply.

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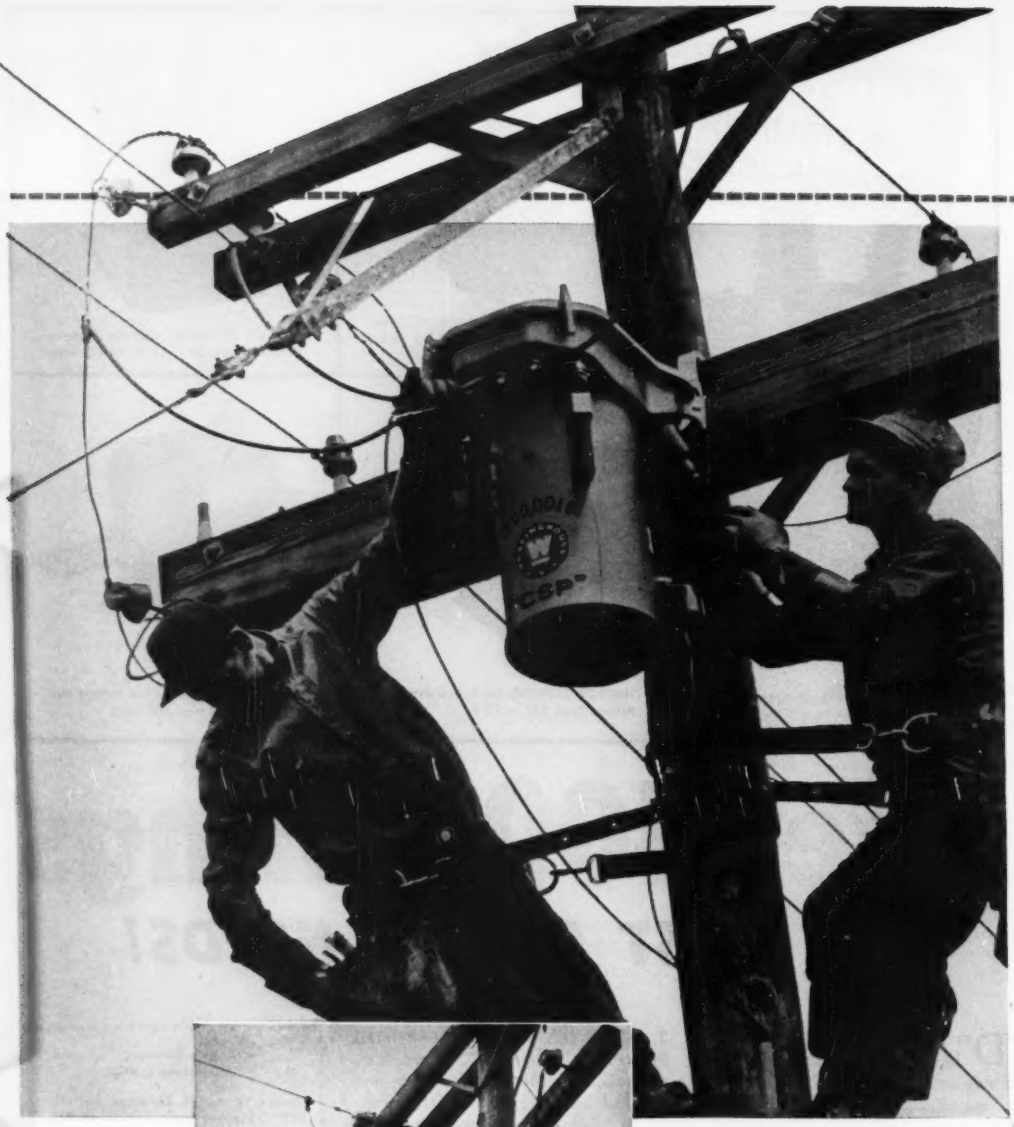


*Above:* Linemen tie in the newest Westinghouse "CSP" Transformer to go on the Ohio Edison system. It's the 1,000,001st "CSP" Distribution Transformer to come off the Westinghouse production line.

*Inset:* The first Westinghouse "CSP" Transformer, installed by Ohio Edison in November, 1933. On Route 8 North of Akron, Ohio, it's still giving dependable service today.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

# SEVENTEEN YEARS

## Proof enough for one customer

Back in 1933, Westinghouse delivered the first of a new type of distribution transformer to Ohio Edison . . . the "CSP" (Completely Self-Protecting) Transformer. Today, seventeen years later, it's still in service. For a "CSP" Transformer, this record is not unusual.

Ohio Edison has standardized on the completely self-protecting type of transformer and in line with this policy, Westinghouse "CSP" number 1,000,001 has been installed on the Ohio Edison System.

Such performance establishes beyond doubt that "CSP" Transformers offer long-range dependability plus savings in operating costs. It's easy for you to prove for yourself that "CSP" Transformers, with both thermal and lightning protection built in, can cut distribution costs for you . . . are economical to install . . . inexpensive to maintain. Ask your Westinghouse representative for a copy of B-4247B, "TRANSFORMER COSTS . . . and their relation to PROFITS". Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

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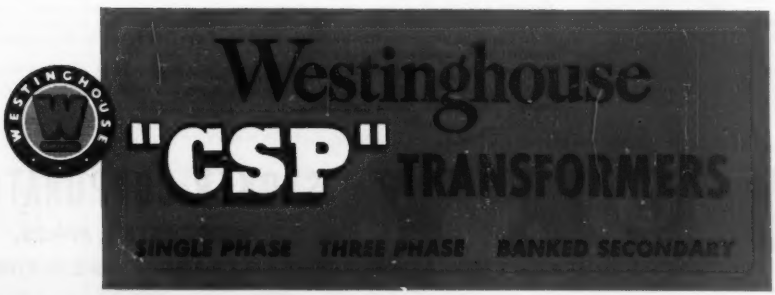
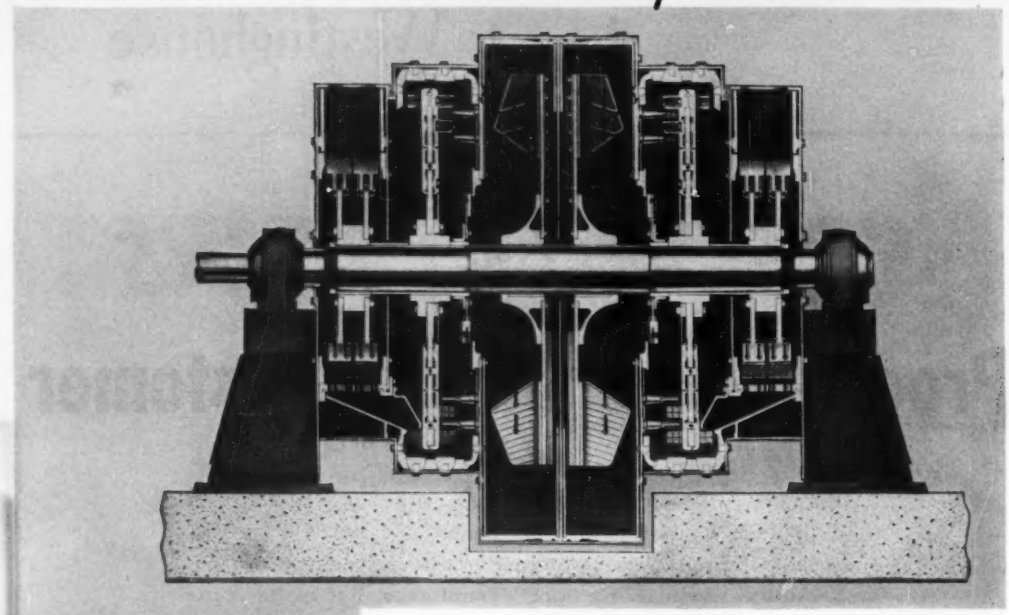


# The NEW "50" Series Riley Pulverizer

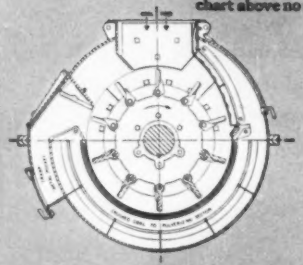


## Pulverizing parts faced with Tungsten Carbide

### Long periods continuous operation
### Low maintenance . . . Sustained fineness

Development of the use of tungsten carbide faced pulverizer parts was started by Riley over ten years ago. Hundreds of existing Riley pulverizers have been equipped. The use of tungsten carbide adds tremendously to the life of the parts. While Riley pulverizers have been in operation for over two years and have pulverized in excess of 50,000 tons of coal, wear of the tungsten carbide is scarcely measurable. These parts are good for many more years of service.

The use of tungsten carbide not only assures long continuous periods of operation without maintenance shutdowns, but because of the extremely long life, greatly reduces maintenance cost per ton of coal pulverized. Fineness of pulverization is sustained without any adjustments whatsoever. You will note from the chart above no reduction in fineness though practically 50,000 tons of coal have been pulverized.



## Preliminary Crusher-Dryer Section

### No capacity reduction with high moisture coals
### Complete reliability

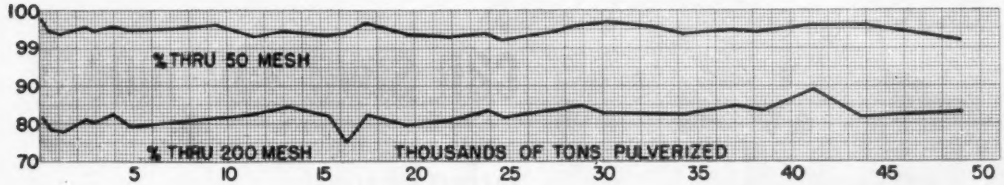
Provided air or furnace gas of sufficient temperature is supplied, there is no capacity reduction with increased moisture content of the coal. The crusher section acts as a flash dryer. In this section coal is crushed to a fine granular state, approximately 40% through a 50-mesh screen, representing about 5% of the work to be done. Coal enters the pulverizing section where 95% of the work is done, with free moisture evaporated from the coal, consequently moisture content of the coal entering the crusher section has no effect on pulverizer capacity.

The crusher section of the pulverizer rejects tramp iron, iron pyrites and other hard foreign substance in the coal, preventing any materials from entering the pulverizer section which could cause damage.

**RILEY STOKER CORPORATION**
**WORCESTER, MASS.**

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

# a most significant Pulverizer Development




## Other Operating Advantages

**in addition to long life, low maintenance, sustained fineness of pulverization . . . no capacity reduction with high moisture coals and complete reliability**

Here is what one user has to say about his Riley pulverizers after equipping them with tungsten carbide parts:

Pleased to advise that in my opinion Riley Mills with carbide elements will outperform any mill today. Original parts installed Sept. 1948 are still going strong and fineness does not go below 80% through 200 mesh. Fully expect mill maintenance cost will run less than three cents per ton.

### Flexibility—Wide Load Range

As change in coal feed gives instantaneous corresponding change in pulverized coal output—there is no lag—rapidly and widely fluctuating loads are efficiently and easily carried.

### Ability to Carry Low Loads

With the combination of Riley pulverizers and burners, extremely low loads with stable ignition can be maintained. It is not unusual for load ranges of 10 to 1 or for loads under 5000 pounds of steam per hour to be carried at Riley installations.

### High Primary Air Temperatures

There is no necessity of limiting primary air temperatures as a precaution against fire or explosion or because of lubricating problems. Expensive control equipment limiting primary air temperatures is not required.

### Ease of Lighting

Because of small percentage of primary air, a rich and readily lighted mixture of air and coal is obtained which together with the uniform distribution with Riley burners makes lighting easy and gives stable flame at low loads.

### Quiet, Vibrationless Operation

There is no comparison between Riley pulverizers and other makes insofar as quiet vibrationless operation is concerned. You hear nothing more than a motor hum.

### Small Space Required—Minimum Foundations

Riley pulverizers require less space per unit of capacity. Massive deep foundations are not required due to their vibrationless quiet operation.

### Explosion Proof

There has never been an explosion in a Riley pulverizer. The velocity of coal travel through the pulverizer is faster than the rate of flame propagation, eliminating the possibility of an explosion.

### These companies have recently ordered new "50" Series Riley Pulverizers

Monongahela Power Company
Albright, W. Va.
Iowa-Illinois Gas & Electric Co.
Davenport, Iowa
Utah Power & Light Co.
Salt Lake City, Utah
Superior Water, Light & Power Co.
Superior, Wisc.
Western Electric Co.
Chicago, Ill.
Carnegie Illinois Steel Co.
Youngstown, Ohio
Celanese Corp. of America
Rock Hill, S. C.
Pittsburgh Plate Glass Co.
New Martinsville, W. Va.
Hooker Electrochemical Co.
Niagara Falls, N. Y.
U. S. Finishing Co.
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Syracuse University
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Riegel Textile Corp.
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City of Austin
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Ciba States Ltd.
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Bell Aircraft Corp.
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Potomac Light and Power Co.
Albright, West Va.
Northern Paper Mills
Green Bay, Wisc.

*A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs*

# COMPLETE STEAM GENERATING UNITS

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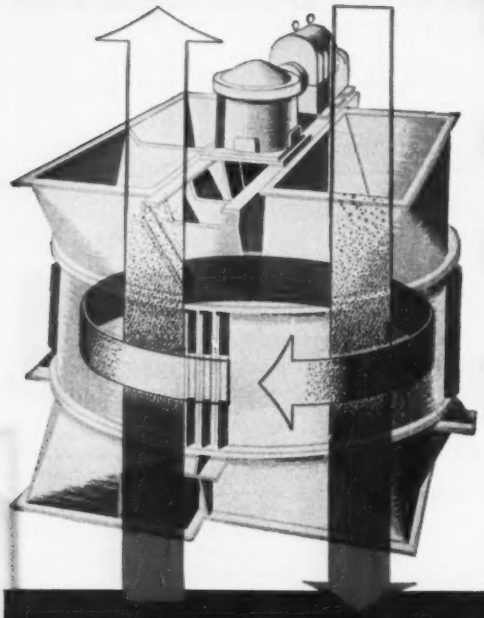


# this preheater can save you money whatever your fuel

## the *Ljungstrom* AIR PREHEATER

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

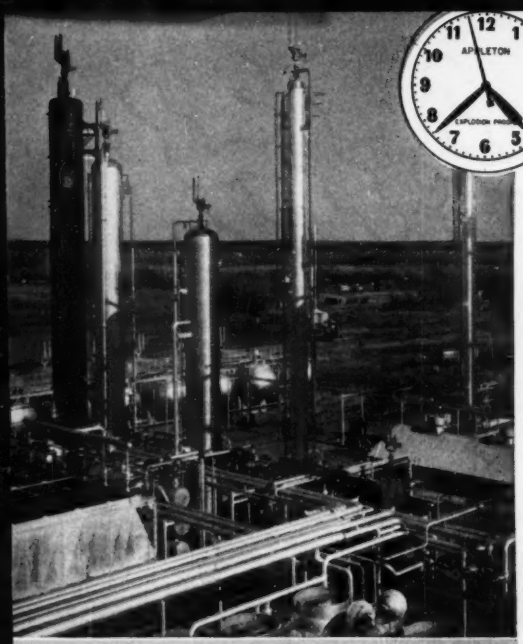
All fuels burn better with preheated combustion air, and it is a "must" for many of them, such as high moisture powdered coal. In addition, the *continuous regenerative counterflow* principle of Ljungstrom permits reliable operation at low exit gas temperature. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

The efficiency and reliability of the Ljungstrom air preheater is a matter of record in industrial and utility plants throughout the country. That is why every year a constantly increasing percentage of the installed boiler capacity is equipped with Ljungstrom air preheaters.

If you are planning a new installation, or modernizing your present one, our engineers will welcome the opportunity to show you how the Ljungstrom can raise the efficiency of your plant.

**THE AIR PREHEATER CORPORATION**

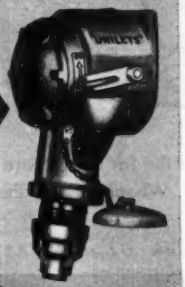
60 East 42nd Street, New York 17, N. Y.



Photo—Oil & Gas Jnl.

New Vented Type EVX Explosion-Proof Lighting Fixture. Available for 60, 100, 150, 200, 300 and 500 Watt Lamps.
Pat. No. 2,530,135

The Appleton Seal-Line Switch Unilet is a combination switch housing and sealing unit. Completely explosion-proof without additional sealing fittings.
Pat. No. 2,208,558



Type FSQX Explosion-Proof and Dust-Tight plug and Receptacle with interlocking safety switch.

THE EFU—First and still finest fluorescent explosion-proof lighting fixture. Available for two 40 watt 48" lamps or two 100 watt 60" lamps.
Pat. No. 2,393,202

'round-the-clock

# PROTECTION

## APPLETON EXPLOSION-PROOF EQUIPMENT

Here are conduit fittings and lighting fixtures designed to provide day-and-night protection against the arcs that touch off disastrous fires and explosions in chemical plants, oil refineries, hospital surgeries—wherever explosive or flammable vapors, dusts or gases are present.

Engineered to completely confine the dangerous sparks that lurk in wiring systems, Appleton Explosion-Proof equipment is easy to install and service. And among the hundreds of fittings and fixtures in the complete Appleton Line is an explosion-proof fitting exactly suited to your needs.

Any wiring or lighting job—explosion-proof or otherwise—is a better job when Appleton fittings and fixtures are used. For the better electrical equipment that means better building, specify Appleton, supplier to American builders for nearly half a century.

*Sold Through Electrical Wholesalers*

**APPLETON ELECTRIC COMPANY**
1705 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

**Branch Offices:** NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Mission St. • ST. LOUIS, 227 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Ave. • ATLANTA, 724 Boulevard, N. E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street • CINCINNATI, 626 Broadway • HOUSTON, 709 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9.

**Resident Representatives:** Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.

**Export Representatives:**
International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

APPLETON ELECTRIC PRODUCTS

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

Years ago we created the character called Micah — symbolic of the far land where best mica comes from and the near-by source of the processed product, MACALLEN mica. Whenever you think of the character Micah think of the mica with character.

*when you think of MICA, think of MACALLEN*

**MACALLEN MICA**

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

**THE MACALLEN COMPANY**

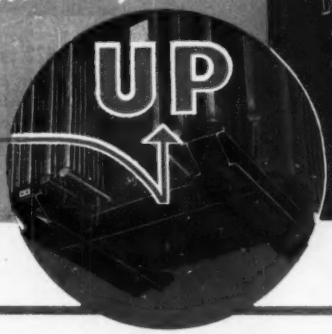
**16 MACALLEN STREET • BOSTON 27, MASS.**

CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.

# *Pennsylvania*
# STANDARD PARTS POWER TRANSFORMERS

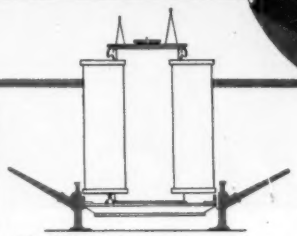
*Designed Right... Built Right...*

**FROM THE BOTTOM UP**

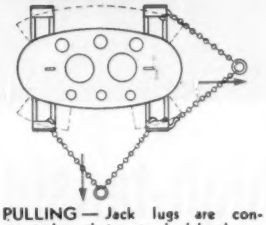


Now available in the following sizes:

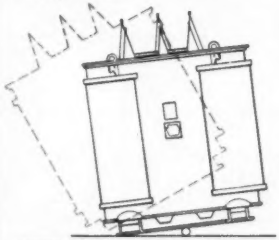
Three Phase: Up to 10,000 Kva, 34 Kv.
Single Phase: Up to 5,000 Kva, 34 Kv.



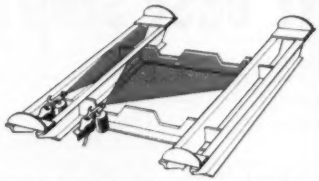
JACKING — Structural steel base members extend to ends of radiators. Radiators offer no interference to jacking. Clearance provided for base of jack to extend under jack lugs. This allows toe of jack to enter all the way under jack lug.



PULLING — Jack lugs are constructed so that a standard hook can be placed in the jack lug to pull the transformer in any direction.



TIPPING — Base design takes into consideration transformer's center of gravity. The largest rolls used cannot tip transformer past its center of gravity.



PAINTING — Ports are provided in base members to ventilate bottom of transformer tank, and to facilitate complete painting of the base and tank bottom. Rust will not attack the tank bottom under these conditions.

A NEW, IMPROVED structural steel base represents one of the outstanding design features in Pennsylvania's new line of Standard Parts Power Transformers.

This base was designed by Pennsylvania Development Engineers after a thorough study of the requirements of a representative group of transformer users. The sketches illustrate how this new base simplifies jacking, pulling, rolling and painting.

Here is another concrete example of Pennsylvania's Engineering Ingenuity.

You'll discover something new if you write for Booklet No. 1492.

Look to Pennsylvania Standard Parts Power Transformers for *lower prices* and *faster deliveries.*

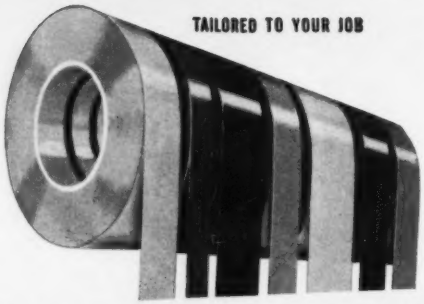
Inert Gas-Oil Seal

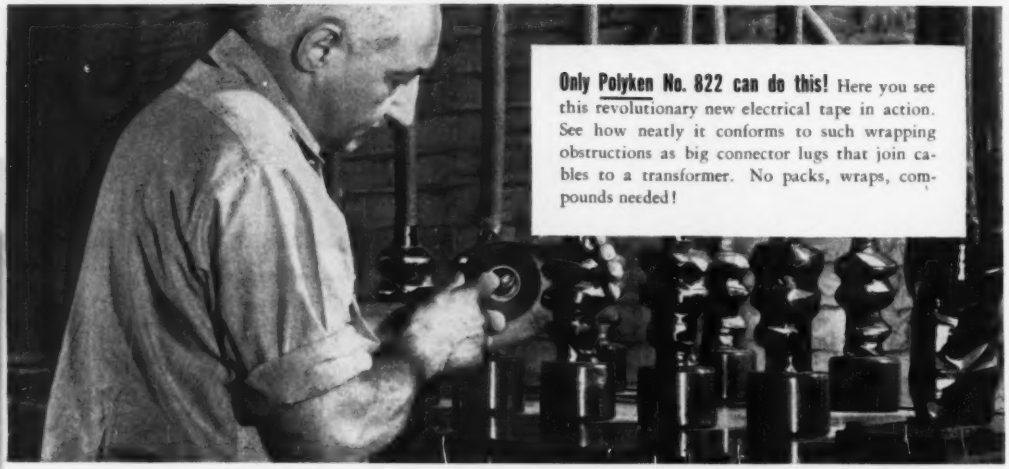
Sealed Tank.

Inert Gas Pressure

*Pennsylvania*
**TRANSFORMER COMPANY**
**CANNONSBURG, PENNSYLVANIA**
***Greater Pittsburgh District***

# THE NEW Polyken® INDUSTRIAL TAPES



**Only Polyken No. 822 can do this!** Here you see this revolutionary new electrical tape in action. See how neatly it conforms to such wrapping obstructions as big connector lugs that join cables to a transformer. No packs, wraps, compounds needed!

# Now wrap high-tension cables in ONE easy step!

Until *Polyken* No. 822 was developed, wrapping high-tension cables was a two-step job. First, a rubber splicing compound, followed by an outer wrap of friction tape.

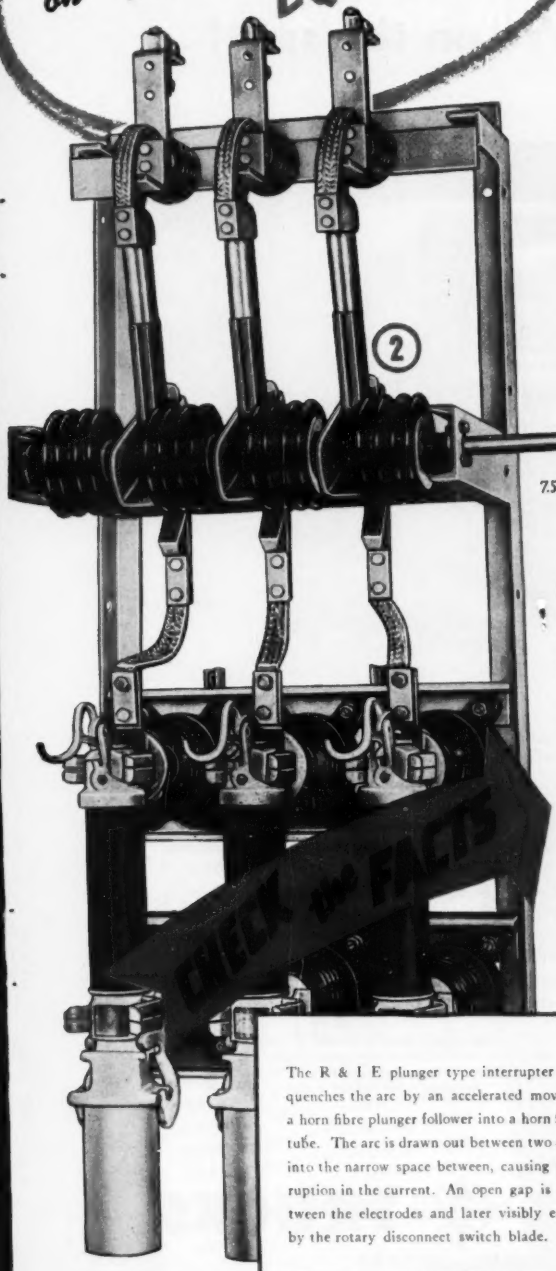
Now you can forget about the rubber compound! *Polyken* Electrical Tape No. 822 is only 9 mils thick—but it's 10,000 volts strong (dielectric strength). Makes *one* quick operation out of two tedious ones with no sacrifice of efficiency.

No. 822 is the only oriented polyethylene tape with a successful pressure-sensitive adhesive. Stretches both ways, so that it covers rough and irregular surfaces. High moisture resistance. Solvent proof. Corrosion proof. For splicing, wrapping, insulating, corrosion coating of cables, wires, controls, pipes, conduits, and hundreds of other uses. Write for free samples today!

**GET FREE SAMPLES** of *Polyken* No. 822, plus complete specifications and engineering data. Write *Polyken*, Dept. EWA 222 West Adams Street, Chicago 6, Illinois.

**Polyken Industrial Tape, Department of Bauer & Black, Division of The Kendall Company**

*Save Money and Worry on* **FAULT PROTECTION EQUIPMENT**




7.5 KV, 400 Ampere Fuses shown.

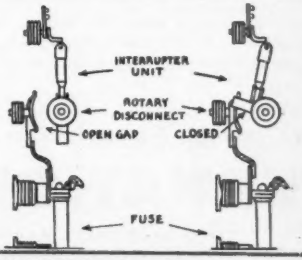
*Install*

R&IE

# INTERRUPTER SWITCHES *at* LOAD CENTERS

1. Compact, easy to install, mounts anywhere—wall, transformer throat, etc.
2. Reliable load interrupter and open gap switch assembly, single or double throw.
3. Operating handle equipped with sequencing device to prevent opening of switch before it is fully closed. This guarantees proper interrupting operation.
4. Provision for Kirk Key Interlock or Solenoid type system.
5. Any fuse combination—below interrupter as shown, or above, if required.
6. Housing can be furnished. Key or mechanical door interlocks optional.

The R & I E plunger type interrupter chamber quenches the arc by an accelerated movement of a horn fibre plunger follower into a horn fibre lined tube. The arc is drawn out between two electrodes into the narrow space between, causing the interruption in the current. An open gap is made between the electrodes and later visibly established by the rotary disconnect switch blade.




I-T-E R&IE

**RAILWAY and INDUSTRIAL ENGINEERING CO., Greensburg, Pa.**
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO
AN I-T-E SUBSIDIARY

*The Check List*

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

# Johnny-on-the-spot

## when you're on the spot!

**For trouble-shooting,** day-to-day maintenance, or construction assignments, there's an International Truck that's *right* for *every* utility job. You're sure of the *right* truck when you pick from the International Truck line—87 basic models, thousands of special variations, ranging from 4,200 to 90,000 pounds GVW.

Every new International Truck, from the smallest to the largest, is heavy-duty engineered for long truck life on tough truck jobs. That's the same extra value engineering that has kept Internationals first in the sale of heavy-duty trucks for 18 straight years . . . that's *extra value* that pays off in longer truck life, lower operating and maintenance costs.

**New comfort in the new Comfo-Vision Cab**

Here is the *driver's dream,* model for model, the "roomiest cab on the road." It has a new kind of comfort in easy-riding cushions, fully adjustable seats, controlled ventilation. The one-piece, scientifically curved Sweepsight windshield provides *outdoor* visibility.

The entire steering system is all-new—engineered for more positive control from a more comfortable position. Shorter wheelbase and wider treads provide the shortest practical turning circle—super-maneuverability in the tightest spots.

No matter what kinds of roads or loads, climate or conditions your trucks must meet, there's a new International that has been proved right for your job *under actual operating conditions.*

Find out all about that truck from your nearest International Truck Dealer or Branch, *soon.*

International Harvester Builds
McCormick Farm Equipment and Farmall Tractors
Motor Trucks . . . Industrial Power
Refrigerators and Freezers

***All new, all proved – Heavy-Duty Engineered to save you money***

# INTERNATIONAL TRUCKS

INTERNATIONAL HARVESTER COMPANY CHICAGO

# LOCKE

*presents masterpieces of*

## insulator engineering

Tens of millions of

**LOCKE SUSPENSION INSULATORS**

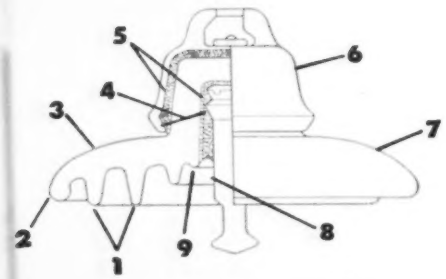
typified by

**No. 1840**

shown above . . . are in use on the world's high voltage transmission lines, some having been up since 1904. Certainly here is eloquent proof of their superior performance and broad acceptance. Specify them on your system.

*Presenting* **A MASTERPIECE OF INSULATOR ENGINEERING**

# The LOCKE Suspension Insulator




## LOCKE DESIGN gives you ALL these advantages

**1.** The contours of the corrugations are such as to give maximum resistance to mechanical impact consistent with total weight and balanced electrical characteristics. The depth of the corrugations assures full leakage distance and maximum impact values.

**2.** The heavy, reinforcing bead on the outer edge of the porcelain shell is an additional assurance against chipping.

**3.** Compression Glaze—a Locke development—assures high resistance to damage from thermal shock or mechanical impact. This means that Locke insulators can be handled faster in construction without danger of chipping or breaking.

**4.** The insulator arch is formed between the cap edge surface as the abutment and the stepped pin as the keystone. Thus while loaded in tension, the porcelain itself is working in compression and the best characteristics of all materials are utilized.

**5.** Locke Compression Sand at the cement joints adds to the strength, and the stability of that strength, throughout the life of the insulator.

**6.** Galvanizing is done by the exclusive Locke Permazinc process—a quality-controlled, double hot-dip method that assures the highest degree of resistance to weathering and corrosion.

**7.** The uniformly smooth glazed surface assures easy natural cleaning by wind and rain, and aids the insulator in maintaining its originally excellent electrical characteristics.

**8.** The large diameter of the pin extends beyond the cement line. This assures cement joints of minimum radial thickness, freedom from troubles arising from thick cement joints, and reduces leakage current concentration (with its resulting corrosion hazard) at this point.

**9.** This small barrier (petticoat) adjacent to the pin reduces leakage streamers and adds to pin life.

**10.** Since Fred M. Locke made the first wet-process porcelain insulator in 1893, a long list of Locke "firsts" has emerged: the first successful cemented type suspension insulator in 1904; the first switch insulator in 1909; the first radio-freed pin type insulator in 1932, to name but three.

**YOU ARE EQUALLY SURE** of masterpieces of design when you specify other products in the complete line of Locke Insulators and Suspension Hardware. Each pays off in superior performance on transmission and distribution lines, generating stations, sub-station and electrical apparatus.

**LOCKE**
INCORPORATED
BALTIMORE • MARYLAND

LOW VOLTAGE PIN TYPE INSULATORS

HIGH VOLTAGE PIN TYPE INSULATORS

SUSPENSION INSULATORS

SWITCH & BUS INSULATORS

SPOOL INSULATORS

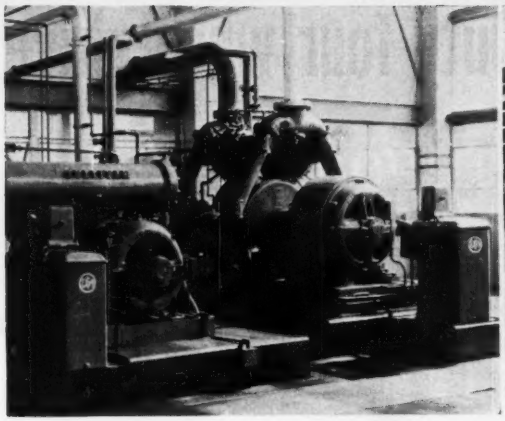
GUY INSULATORS

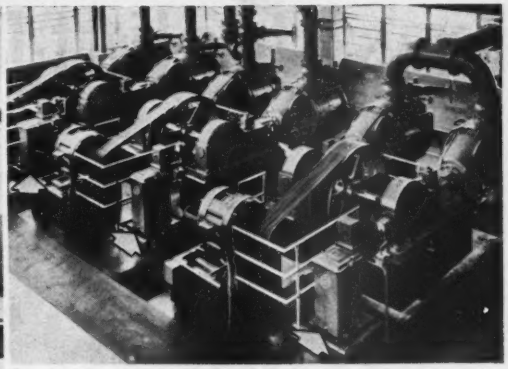
LIQUID-FILLED BUSHINGS

SUSPENSION & STRAIN CLAMPS

SUSPENSION HARDWARE

ENTRANCE BUSHINGS





. . . ON AIR COMPRESSORS . . . ON VACUUM PUMPS

***In Protected Rooms, in Coastal Atmospheres, in Dusty Locations...***

# EC&M OIL-IMMERSED MOTOR STARTERS

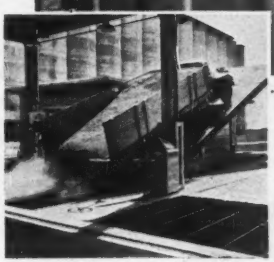
## *HELP SPEED PRODUCTION IN GULF COAST PLANT*

These EC&M reduced-voltage Motor Starters are very popular in industrial plants. *Automatic operation* from push-button stations brings squirrel-cage or synchronous motors up to speed quickly, safely—with greater skill than human hands can do it.

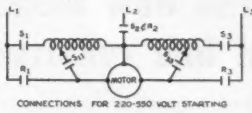
Oil-immersed, the simple double-throw contactor is always well lubricated and protected from corrosion—eliminating the need for frequent inspection or maintenance. Motor circuits are made and broken under oil—thoroughly safe, no dust hazards.

Magnetic overload relays in these starters give inverse-time-element protection and also *trip instantly* on heavy over-currents. A magnetic balance in each relay absorbs heavy starting currents and allows a *low* current-setting for accurate protection under running conditions. EC&M Motor Starters have a reputation for low up-keep cost.

. . ON PROCESS MACHINES



GRAIN RECEIVING STATION




CONNECTIONS FOR 220-550 VOLT STARTING

Complete compensator

Compensator mechanism

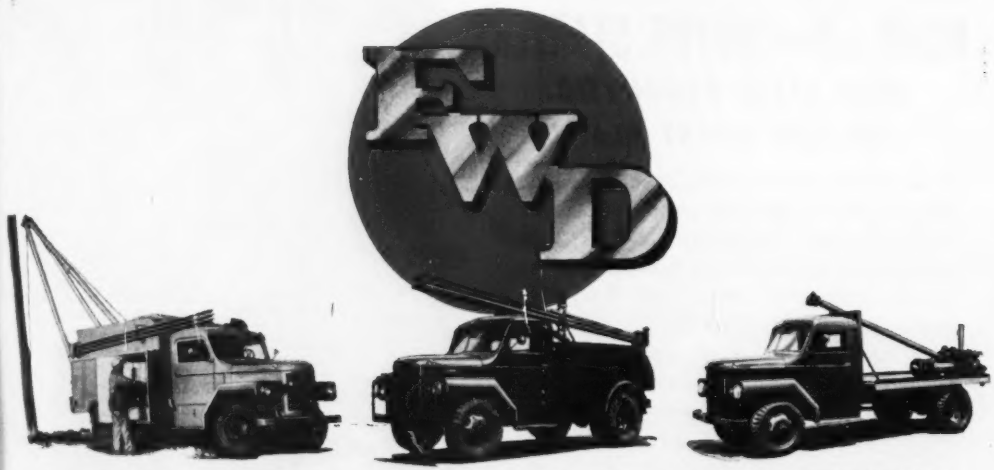
***Write for Bulletin 1045 and No. 19 ACCELERATOR Bulletin***

**THE ELECTRIC CONTROLLER & MFG. CO.**

2698 EAST 79TH STREET • CLEVELAND 4, OHIO

# Here's a true Light-Duty four wheel drive

# in answer to demand from utility men




A new LD chassis with tripod derrick and maintenance body being used off the highway.

A special utility-designed service body — one of several LD's placed in service by an eastern utility.

An FWD earth boring rig with full-torque power take-off mounted on the new LD chassis.

## NOW... the new Model LD can be supplied with standardized line construction and maintenance bodies

In only a few short months, this *true* light-duty four-wheel-drive, has completely proved itself on utility applications. It has successfully filled the gap which conventional trucks and conversions have long sought to do. You'll find the LD bringing all the acknowledged FWD advantages to an entirely new FWD work range, It gives you a safe, economical opportunity to work on or off the highway — on a great variety of jobs — with small crew units. Investigate the LD today. Find out how it creates important dollar-savings and out-performs other vehicles. The Four Wheel Drive Auto Co., Clintonville, Wis., *Canadian Factory:* Kitchener, Ontario.

Get all the facts on the new LD — plus data on how FWD's do a real job on all types of utility applications...with over 40 different line construction and maintenance units. Ask for the two bulletins —"The Story of the LD" and "Get More Work Done". See Graybar or write FWD direct.

*Built by the Makers of America's Foremost Heavy-Duty Trucks*

# *for* Convenient *and* Accurate Measurements

This completely self-contained, portable, lightweight and accurate bridge is always set up and ready to measure these important electrical quantities over very wide ranges:

**Inductance:** *1 microhenry to 100 henrys*

**Resistance:** *1 milliohm to 1 megohm*

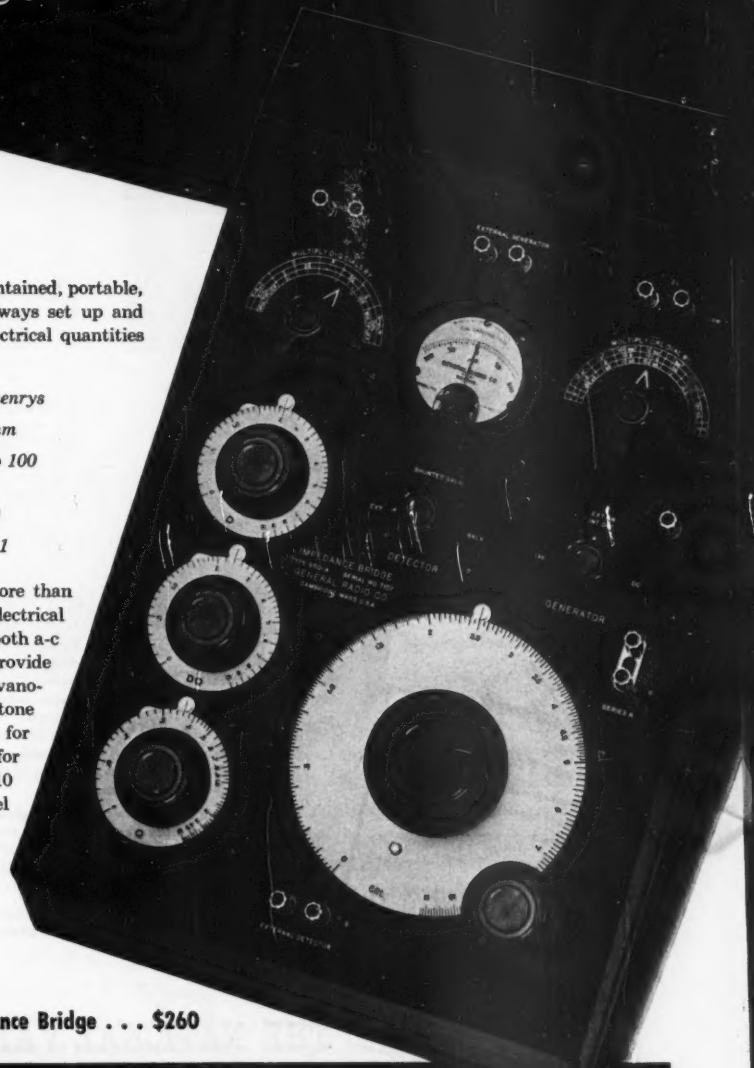
**Capacitance:** *1 micromicrofarad to 100 microfarads*

**Storage Factor (X/R):** *0.02 to 1000*

**Dissipation Factor (R/X):** *0.002 to 1*

The accuracies obtained are more than sufficient for a large majority of electrical measurements. Provision is made for both a-c and d-c operation. Four dry cells provide the d-c power, with a zero-center galvanometer as the detector; a 1,000-cycle tone source is used for a-c with terminals for headset detection. External generator for measurements from a few cycles to 10 kilocycles can be connected to panel terminals.

Thousands of these bridges are in use in leading laboratories throughout the world. You'll find that once you have used one you can't do without it.




**Type 650-A Impedance Bridge . . . $260**

**GENERAL RADIO COMPANY** Cambridge 39, Mass.

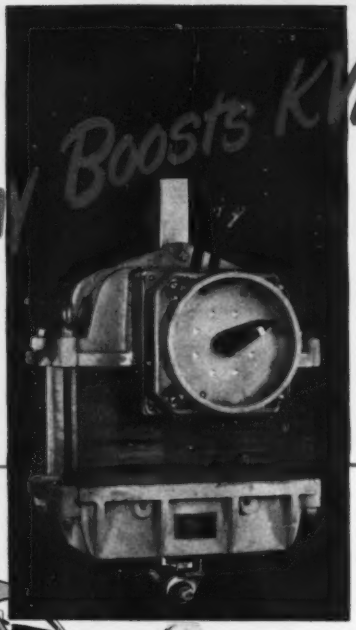
920 S. Michigan Ave., Chicago 5 90 West St., New York 6 1000 N. Seward St., Los Angeles 38

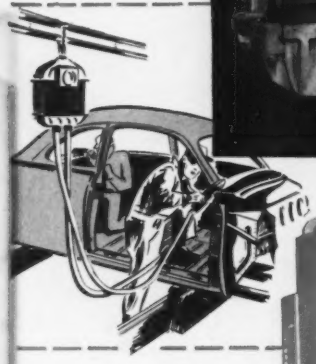
*Write for Complete Data*

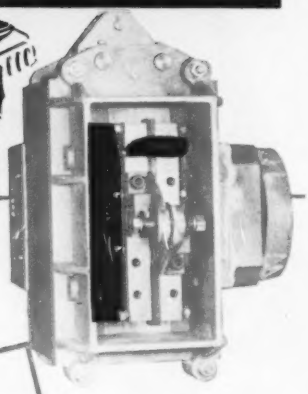
# McCarthy Boosts KVA Rating 30%

with

# NATVAR VARNISHED FIBERGLAS







This McCarthy Type 325-PG welding transformer is compact and weighs only 458 pounds, yet it is rated 75KVA, 220 or 440 primary volts (not interchangeable), 60 cycle, 1 phase, 108°C temperature rise, at 50% duty cycle. An extra heavy heat selector switch gives secondary voltages in eight steps from 5.00 to 9.16, parallel connection, or 10.0 to 18.32, series connection.

Primary coils are insulated between turns with Natvar varnished Fiberglas tape, dipped and baked. The wound coil is then insulated with mica and Natvar varnished Fiberglas tape, again dipped and baked, and finished with air drying varnish. Secondary coils are heavy wall square copper tubes through which cooling water circulates. Leads are insulated and protected with Natvar 400 heat resistant extruded vinyl tubing.

McCARTHY ELECTRIC CO., Detroit, manufactures welding transformers used extensively on production lines in the automotive industry for welding bodies and various fabricated parts, and in the refrigerator industry for welding boxes. Since it is more practical to weld large assemblies with guns rather than on stationary machines, portability is important. Size and weight of the transformer must therefore be kept at a minimum. And because many of these units are in continuous service 24 hours a day, long life is important, too.

By designing and building these transformers for higher continuous operating temperatures, McCarthy has succeeded in raising capacity 30% without increasing the size or weight. McCarthy has standardized on Natvar varnished Fiberglas and Natvar 400 Extruded Vinyl Tubing because of their uniformly high resistance to heat, and because both have exceptional aging characteristics, which means longer life.

All Natvar flexible insulations are consistently uniform, no matter when or where purchased. They are immediately available either from your wholesalers' stocks or direct from our own.

Natvar

**Natvar Products**

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing and tape
- Extruded vinyl identification markers

Ask for Catalog No. 21

**THE NATIONAL VARNISHED PRODUCTS Corporation**

Telephone Rahway 7-8800

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221 RANDOLPH AVENUE ★ WOODBRIDGE, NEW JERSEY

# Gulfcrest Oil Selected

## for another big power plant . . . 300,000 kw

High-pressure unit of one of the two 150,000 kw cross-compound steam turbo-generators recently installed at the Philip Sporn Plant of the Ohio Power and Appalachian Electric Power Companies, New Haven, West Virginia. Two 150,000 kw units are lubricated with Gulfcrest Oil.

**Two more big turbines get the safe, sure, long-lasting protection of Gulfcrest, the world's finest turbine oil!**

**Another case, too, where outstanding performance in other turbines operated by the same utility led to the selection of Gulfcrest Oil for the new units!**

**Extra refining makes the difference! After the carefully selected crude oil used in Gulfcrest goes through the major refining methods, it is then superrefined by the Alchlor Process.**

**This exclusive Gulf process removes the hydrocarbons most apt to oxidize and form sludge, emulsifiers, and harmful acids in turbine lubricating systems.**

**That's why Gulfcrest is incomparably pure—why it gives outstanding performance, and lasts indefinitely. Call in a Gulf Lubrication Engineer today for complete information on this superior oil. Write, wire, or phone your nearest Gulf office. Gulf Oil Corporation · Gulf Refining Company, Gulf Building, Pittsburgh, Pennsylvania.**

FIFTY YEARS OF SERVICE
1901 GULF 1951
PETROLEUM AND ITS PRODUCTS

# It's your money!

The dollars represented by your accounts receivable are yours; it's your problem to *get them in.*

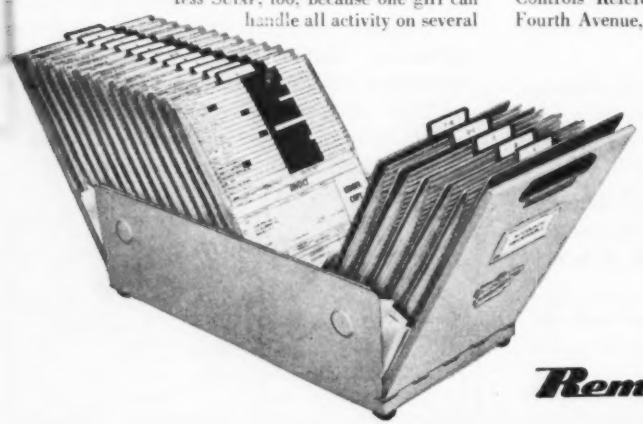
SUIAP, the Simplified Unit Invoice Accounting Plan, can help speed and intensify your collection activity, because it automatically and visibly ages each account. You know at all times whether average collection times are slowing up. You are warned when action is needed. Each account that requires attention stands out, because the colored Graph-A-Matic signal spot-lights delinquency.

Your form notices are sent on schedule. When getting-down-to-cases collection letters are required, they go out, backed by complete credit information and accurate accounting.

There's cost-of-operation saving with *ledgerless* SUIAP, too, because one girl can handle all activity on several thousand accounts. She can authorize credit from a glance at her records, enter each charge by filing the invoice copy in the customer's Kolect-A-Matic Visible Ledger Pocket. Ledgers are balanced by establishing simple controls for all debits and credits. Payments are "applied" by removing copies of all paid invoices and date-stamping "PAID".

SUIAP gives you *visible control* of an integrated, economical accounts receivable operation, simplifies your procedure as no other system can, *gets the money in* with less effort and delay.

For full details on cost-saving SUIAP, send today for folder KD-554 — write to Management Controls Reference Library, Room 1630, 315 Fourth Avenue, New York 10.



**The graphic panels in the Kolect-A-Matic Tray put the finger on slow-pays. No need to search through dozens of accounts to find the few that require attention . . . *the colored signals red-line delinquencies. SUIAP* is fire-safe, too; its Safe-Desk housing provides *certified* protection against fire and impact.**

**Remington Rand Inc.**

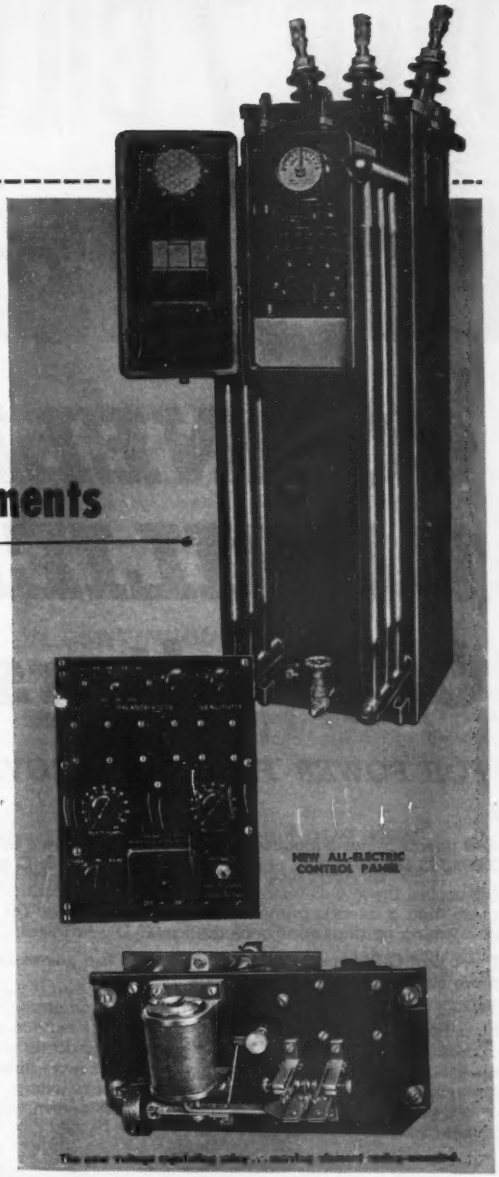
**THE FIRST NAME IN BUSINESS SYSTEMS**

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

# *More Dependable Regulation*

## without Mechanical Adjustments




**Easier to operate!**
**Greater freedom from maintenance problems!**
The new Westinghouse Induction Regulators give even more dependable regulation, with an all-electric control that eliminates mechanical adjustments.

**All-electric control . . . easy to adjust:**
Balance voltage and band width are determined by position of calibrated knobs and tap plug. That's all there is to it. Adjustments may be made without disturbing the line-drop compensator; either setting may be changed without interrupting service.

**Rugged spring mounting eliminates delicate bearings:**
Here's a nuisance maintenance problem licked! No more risk of trouble from mechanical bearings.

**Spring-mounted . . . snap-action elements:**
Motor operating relay has all moving parts spring-mounted, arranged to eliminate all armature impact . . . assures long life.

**"Lifetime" contacts:**
Another maintenance headache cured! Heavy silver contacts are designed to last the life of the unit.

Available in three models to meet all urban station requirements. Type SU, oil cooled. Type SA, air cooled. Type SI, Inerteen (R) cooled. For further information, ask your Westinghouse representative for a copy of B-4736, *Westinghouse Voltage Regulators for Urban Substations,* or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.
J-10351-A

Westinghouse
VOLTAGE REGULATORS
for ANY system

# OVER 7 BILLION KVAR

## of capacitor

# CORNELL-DUBILIER Capacitors

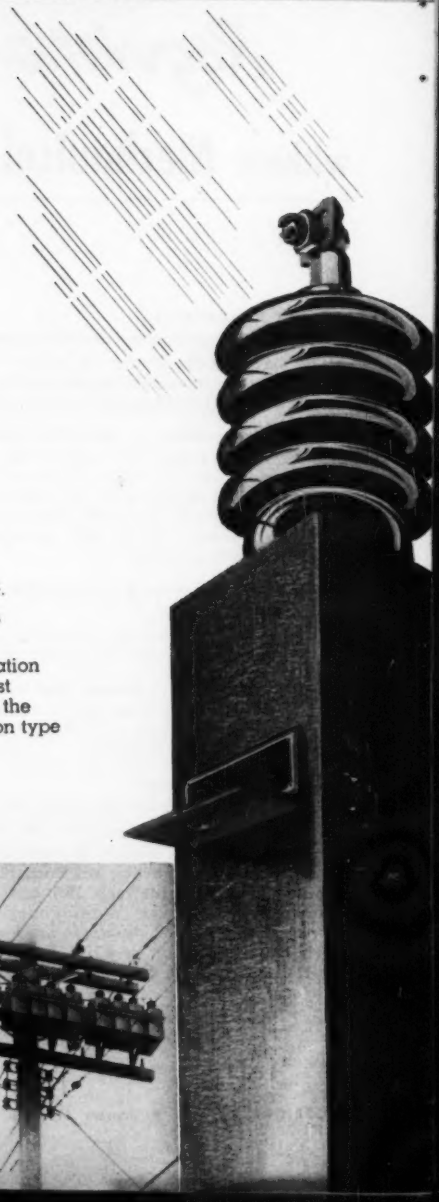
### FOR POWER-FACTOR IMPROVEMENT

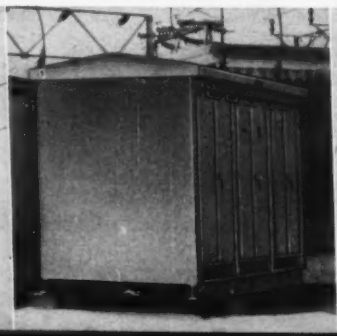
**C-D power-factor capacitors are field proved! Here's evidence: 7,007,763,480 Kvar/hrs. of capacitor service at P. S. E. and G. of N. J.**

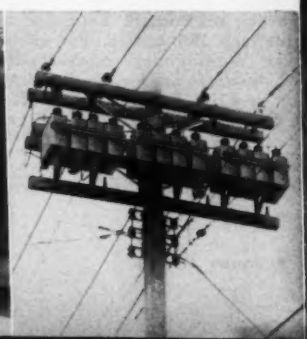
Several of these C-D installations have been in continuous service for more than a decade with little or no maintenance. Yet, they're still performing as dependably as the last C-D unit installed by P. S. E. & G.

**Proof that C-D's specialized experience in the power-factor field means more capacitor value for your dollar!**

Among the many other reasons why C-D capacitors, both pole and station type, have given so many years of satisfactory service under the severest operating conditions is C-D's engineering standards which provide for the lowest dielectric unit stress and highest major insulation level. C-D station type capacitors can be provided in weatherproof housings, switched or unswitched and completely assembled for energizing at field site, to meet specific sub-station needs.

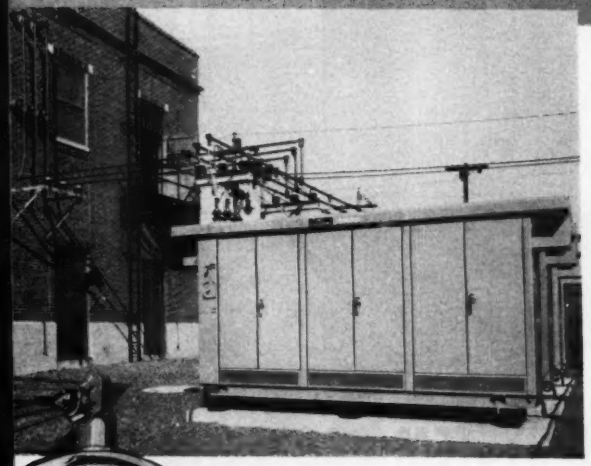






# HRS. service

at PUBLIC SERVICE ELECTRIC AND GAS of New Jersey



## RACKS COMPLETELY ASSEMBLED AT THE FACTORY!

Evidence of the practical design and construction of this C-D station type rack equipment: *It's completely assembled at the factory, and shipped ready for field energization.* This time-conserving, money-saving feature is typical of C-D's leadership in maintaining the highest engineering standards in the capacitor field at the lowest possible cost.

## IN CONTINUOUS SERVICE

A typical C-D capacitor installation at P. S. E. and G. of N. J. — one of several sub-stations showing 7,920 Kvar station-type capacitors of a total of 134,961 Kvar. Designed to maintain stable bus voltage level during periods of maximum load in a highly concentrated industrial area.

## More reasons why C-D capacitors have met P. S. E. & G. field performance requirements!

- Lowest dielectric unit stress and highest major dielectric insulation level!
- Dykanol-filled bushings increase accepted flash-over safety factor, insure high level of impulse withstand!
- Removable solderless connectors instead of permanent split-stud assemblies!
- Many small sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor; lowest dielectric unit stress.
- Terminal discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution.
- C-D design results in the lowest volt-amperes per square inch of radiating surface.

Get these cost-saving capacitor extras – Only available with C-D's. A C-D field engineer will be glad to discuss your specific requirements for power-factor improvement. *Write for catalog today.*

CORNELL-DUBILIER ELECTRIC CORP., Dept. D-100, South Plainfield, N. J.

*Other plants in New Bedford, Worcester and Brookline, Mass.; Providence, R. I.: Indianapolis, Ind.; and Cleveland, Ohio.*

40TH ANNIVERSARY CORNELL-DUBILIER CAPACITORS 1910-1951

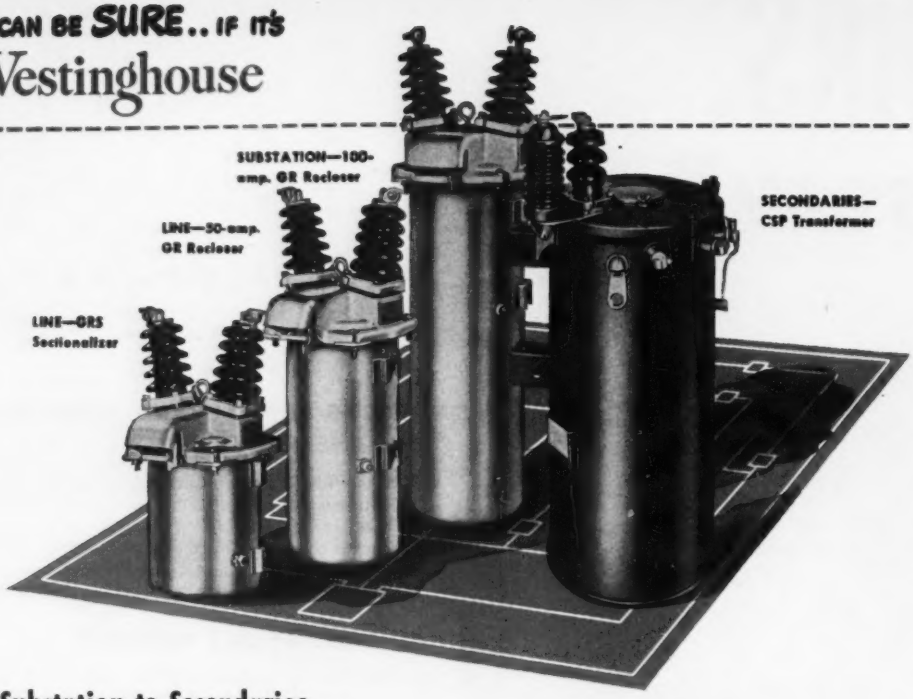
# CORNELL-DUBILIER

## CAPACITORS

BEST BY FIELD TEST

YOU CAN BE **SURE**.. IF IT'S

Westinghouse




## From Substation to Secondaries...

# COMPLETELY MECHANICAL SYSTEM PROTECTION

### ...for lower, long-term distribution costs!

In this case, "mechanical" means a *fuseless* protective system... and one which promises many long-term, cost-saving advantages for rural and suburban lines. Specifically, it's a system which eliminates fuse replacement costs; which stays in proper co-ordination *permanently;* which simplifies the job of re-energizing faulted lines.

Its basic elements are those pictured above. The new Westinghouse GRS Sectionalizer, which is used in place of fuses, is its key component. Co-ordinated with substation reclosers, line reclosers and CSP Transformers, the sectionalizer permits—for the first time—attainment of a completely automatic, mechanical protective system... a *sure* way to gain this important objective:

***The highest degree of service continuity at the lowest long-term cost!***

The mechanical protective system is one of those analyzed in Booklet B-4700, which covers advantages, limitations and cost considerations of all types of protective schemes for rural and suburban lines. For your copy of this practical guide to better protection planning, write: Westinghouse Electric Corp., P.O. Box 868, Pittsburgh30, Pa.

J-60738

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Plastic Tape

Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

# ACCURATE TAPES

**...for every INSULATING need!**

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High grade rubber carefully compounded with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M. grades.

## ...no finer tapes at any price!

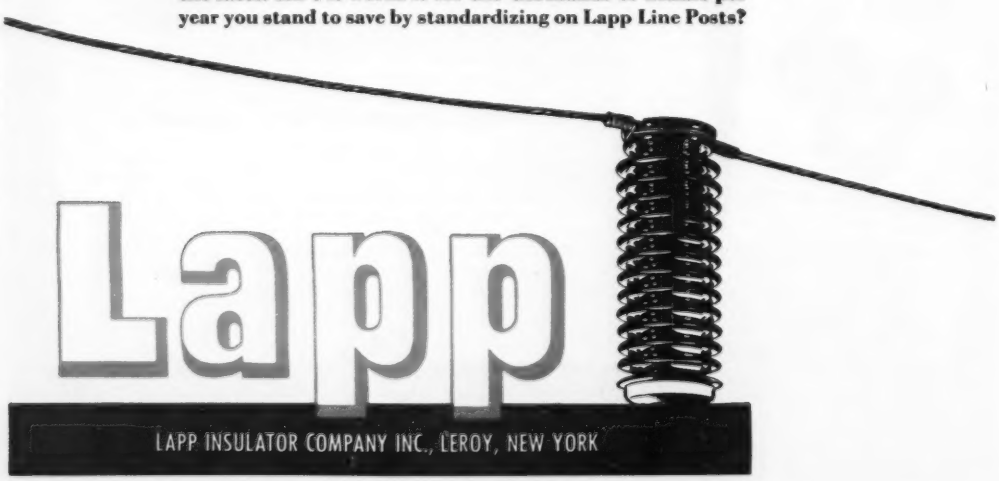
For big wiring jobs or small, Accurate is the choice for positive tape protection. Both friction and rubber are strong, pliable, easy to apply. Accurate tapes make accurate wraps — pull tight and clean over irregular surfaces. When you order tape, mention Accurate by name. It's the one sure way to complete tape satisfaction. For a complete guide to tape selection and tape buying, ask for the new Accurate Data Folder. Accurate Mfg. Company, Garfield, New Jersey — address inquiries to Dept. AA.

# Why Not Shock Yourself?

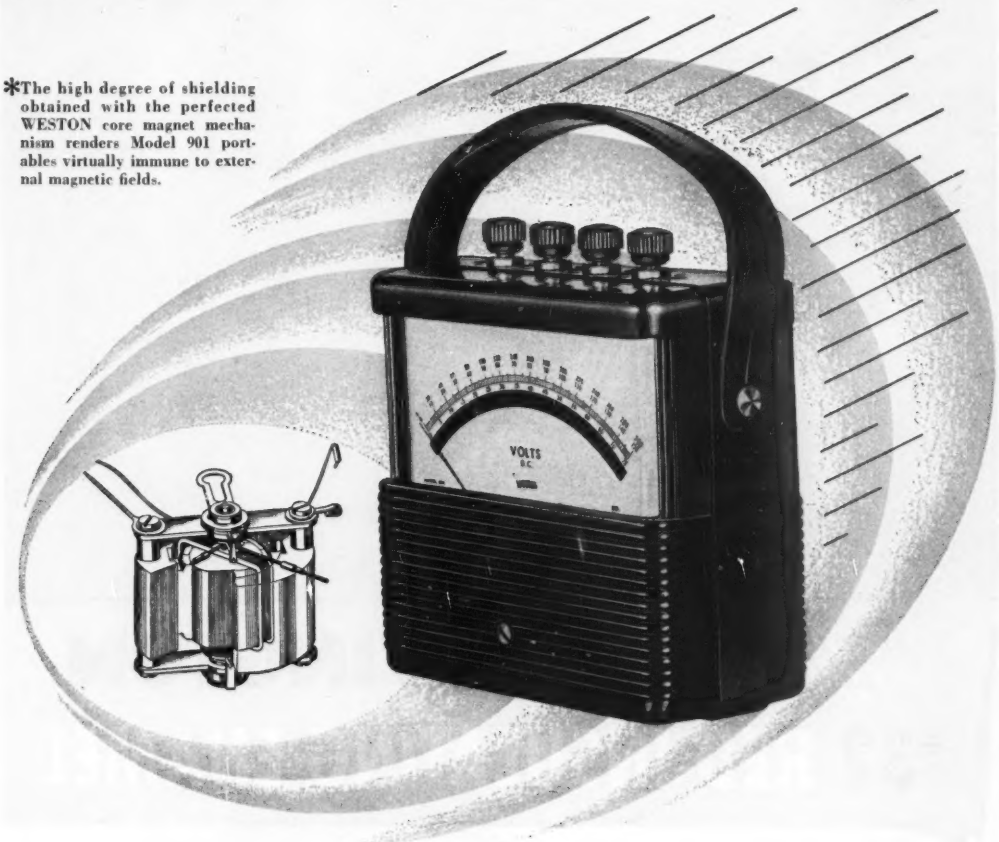
● If you're like most engineers responsible for the operation of transmission lines, you've probably largely lost track in recent years of insulator performance records. It seems rather popular these days to assume that high-voltage insulators are generally "All right." So usually there's a rude shock waiting for any engineer or executive who goes to the trouble of actually finding out what the annual cost for transmission insulator maintenance in his company really adds up to. Those costs do go on, because there's little about conventional transmission insulators today that make them much better than they were 20 years ago, when practically all companies kept a sharp eye on maintenance costs.

But there's one notable exception to all this. The Lapp Line Post. This advanced insulator design now has a 19-year service record. On line after line, all across the country, it has proved its ability to cut insulator maintenance cost to a tiny fraction of that run up by pin-type insulators.

A careful analysis of your own service records will show you the facts. Isn't it worth it for the thousands of dollars per year you stand to save by standardizing on Lapp Line Posts?



# *Inherently SHIELDED




*The high degree of shielding obtained with the perfected WESTON core magnet mechanism renders Model 901 portables virtually immune to external magnetic fields.

For years instrument engineers have tried to build the magnet inside the moving coil for a more compact, more stable, inherently shielded d-c mechanism. In the Model 901 d-c portable instruments, Weston provides a practical and proved design of this type. The Weston core magnet construction gives uniform flux field over a wide deflection angle . . . withstands extreme mechanical abuse . . . and is exceptionally well shielded without increase in size and with a reduction in weight. Be sure to get the details of this remarkable development from your local Weston Representative, or write Weston Electrical Instrument Corporation, 594 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and Tagliabue instruments.

## WESTON *Instruments*

# 2 Good Reasons...

...for using IRVINGTON #32 RED INSULATING ENAMEL

**1** **It saves money** *because it costs less!*

**2** **It saves money** *because it dries fast!*

*Look to Irvington* *for insulation leadership*

Now you can save time, save money, on every electrical finish-enamel job. With Irvington's new #32 Red Oilproof Insulating Enamel, you get new speed of drying, new low cost. And you also get the bonus protection of a tough, impervious, 800 volt-per-mil insulation. Write today for technical data and samples.

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## BEFORE YOU INVEST IN LIGHTING MAKE SURE OF ITS *OVERALL* COST

First cost is only *first* cost—not total cost—of lighting. Cost of installation and maintenance should be considered, too. You must figure all three to get the OVERALL COST of your lighting investment.

LOW OVERALL COST is a feature of Miller lighting equipment. It has engineering features that make for easy installation and maintenance. It is built on an 8-Point QUALITY standard which includes rigid "Truss" construction, Bonderite-treated steel and long-life finishes.

107 years' experience in pioneering and progress in Good Lighting is behind all Miller lighting equipment—Fluorescent, Incandescent, and Mercury-vapor—for a wide range of industrial and commercial lighting requirements.

Miller field engineers and distributors are conveniently located for nation-wide service.

**THE miller COMPANY** MERIDEN, CONN.
SINCE 1844

ILLUMINATING DIVISION: Fluorescent, Incandescent, Mercury Lighting Equipment
HEATING PRODUCTS DIVISION: Domestic Oil Burners and Liquid Fuel Devices
ROLLING MILL DIVISION: Phosphor Bronze and Brass in Sheets, Strips and Rolls

# PERMANENTLY FORTIFIED
## for Life-Time Wiring Protection

Unlike ordinary rigid steel conduit, SHERARDUCT is fortified—*permanently fortified*—against rust and corrosion by the Sherardizing Process of dry galvanizing. A pure zinc coating, driven into the pores of the steel, becomes an integral part of the tube itself because it's *alloyed with the steel.* Furthermore, SHERARDUCT will not split or peel, and although it can be bent easily, it will not crack!

SHERARDUCT is still further protected against acids and other corrosive agents by the clear "Shera-Solution" coating, baked on for added endurance. The smooth inside surface makes fishing easy.

Specify SHERARDUCT. It's full weight, threaded, rigid steel conduit—*fortified* to give wires and cables a *life-time of protection.*

Sold through leading electrical wholesalers.
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# National Electric
## PRODUCTS CORPORATION

1305 CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PA.

Electrical World — Editorials

# Conservation of Material

It has been estimated by General Electric Co engineers that the copper required from the generating station through the distribution circuits of a power system amounts to about 15 lb per kilowatt of peak load. About one third of this is within the power station itself. This leaves the other two thirds of copper use for the rest of the power system, including transformers, lines, switchgear, etc. As material shortages accumulate, the electrical industry is challenged to find ways to conserve a portion of this other ten pounds of copper per kilowatt beyond the generating station.

Much progress grew out of the last war in economy in use of equipment as well as in design. Considerable impetus was given to such ideas as temperature loading of generators and transformers, elimination of generator busses, higher voltage transmission and distribution, unit substations, standardization of equipment, and economy in design of lines. There is no way to estimate how much material and money has been saved by these practices but all will concede that it is substantial. As pointed out in a Westinghouse Electric Corp study covered in the Dec 25 issue of Electrical World, with all possible reductions in investment cost of generating-plant transformer banks a dollar saving of 60% can be made compared with 10 years ago. Giving full consideration to the advances already made, there is general agreement among both manufacturers and utility engineers that much progress can still be made in the field of standardization and improved design techniques to save critical material and manpower.

In the field of operation and maintenance numerous conservation methods were adopted during World War II. Such methods will have to become common practice again if America rearms at the rate now contemplated. The materials may now be available to carry out jobs in the same old way. But the industry has a great responsibility to look ahead toward the time when shortages will be rampant.

It is now apparent that within the next few months strict controls will be placed upon the installation of all power system equipment from the generating plant through the distribution system. It is none too early to begin taking the most stringent measures and to prepare long-range plans for the conservation of material and manpower.

## Is WWP Next?

The deep silence regarding activities of the American Power & Light Co towards the disposition of Washington Water Power Co has now been broken. It is common knowledge in the Northwest that negotiations have been going on in connection with the plan for the acquisition of Washington Water Power stock by the Chelan County Public Utility District. It seems that a resolution was passed by the PUD board but that such a resolution has not yet been made a matter of record. Therefore it is believed, but has not been proved, that such a plan has been agreed upon.

The certainty that a plan exists to buy Washington Water Power stock is attested to by the fact that suits have been filed by several parties to enjoin the public utility districts from making the purchase. In addition to the possible retarding effect of the suits which have been brought, it is possible that this new scheme to sell to public power may be blocked by public opinion and SEC action long overdue. It is quite significant that a taxpayer group has awakened to the fact that they will be the losers should Washington Water Power property be sold to the PUD group. It is about time some of the national authorities realized the significance of this PUD scheme. Perhaps the SEC will now understand more clearly why various stockholders and the commissions of both Washington and Idaho have insisted that American Power & Light distribute Washington Water Power Co stock. Certainly it is high time that some action be taken in this matter.

## The Versatile Heat Pump

Peering into the future of the heat-pump water heater, one sees quite clearly that this interesting appliance will have to be sold as considerably more than just a source of hot water. Its initial cost will be much higher than its subsidiary, that of a resistance-type heater, and its coefficient of performance appears to be in the range of 2 to 3. With present low rates for water heating service it is more than questionable whether or not the COP advantage will be sufficient to offset the greater first cost of the heat pump device.

Appreciating this prospective difficulty, the developers of the new appliance are now giving thought to its by-product performance in supplying cooled air. Basements, where water heaters are usually installed, are frequently damp places, and the new machine, which can be used for drying out the basement air, can be sold as a preventer of must and mold. Or if the house has a hot air heating system, connection may be made to send cooled air to one or more rooms.

But why should thinking stop at these by-products? Possibly the heat pump has a larger destiny than piecemeal application in the home—one machine for food preservation from day to day, another for food freezing and holding over long periods, another for hot water, and a fourth for comfort heating and cooling. The whole economy of electricity supply is built upon the idea of one machine doing the work of many. May not the same idea apply to the heat pump—one machine in the home performing all heating and cooling functions? There are many problems in the way of this idea. To say they cannot be solved is to deny progress.

## Interconnection Communication

Several answers can often be found for the problem—what form of communication shall be chosen for important links of a power system? Initial cost and annual charges are not the sole answer because reliability is a common requisite. Reliability alone would throw the vote in favor of a cable or a radio link because the most vulnerable element is the wire line whether the carrier be telephone or power line. Wire lines are subject to breaks by wind, ice, trees, and errant motor vehicles, and the carrier seldom can be depended upon when the wires are on the ground.

Microwave transmission is virtually as dependable as the terminals once it has been placed to dodge or bend around the line-of-sight obstructions. But it is reported to cost more per channel-mile per year unless the system is used for three or more channels. Distance, of course, dilutes the cost of any form of communication per mile. Least expensive of all is, of course, the carrier system applied to a telephone circuit. But it is not always dependable. Microwave radio may well be the most dependable.

Power line carrier does not benefit as much in cost per channel-mile years as the other two forms as the number of provided channels is increased. It might benefit more in versatility, scope, and general adequacy if better use were made of the frequency allocations by better coordinating the frequencies in contiguous areas. However, in due course, the increased requirement for channels will probably render the radio link the most feasible to adopt.

## Economic Education

Even the school teachers of our country are sadly lacking in knowledge of our economic system. After attending a workshop in economics, a teacher said, "I knew nothing about economics when I came. Now I am so interested I am determined to learn."

The Joint Council on Economic Education which is sponsored by the Committee for Economic Development has set a new movement afoot in the field of education. In the two years since this program was inaugurated, practical everyday economics has been invading classrooms all over the country. The teacher attends a workshop and then organizes local groups to further economic education in the school and community.

Business men as well as educators can and should support this activity.

# The Electrical Week

IN WASHINGTON—The Tennessee Valley Authority announced in Knoxville Jan. 8 that construction will get underway immediately on two giant steam plants, the Paducah Plant, 15 miles south of Paducah, Ky., on the Ohio River, and the Swans Pond Plant, two miles from Kingston, Tenn. (p 41) . . . Getting power for defense needs and materials for expansion of utility generating capacity are the big jobs of the Defense Power Administration, according to its new administrator Clifford B. McManus (p 42) . . . The first money loaned to industry by the government is now being spent. RFC made the first loan, $775,000, to the Standard Cable Corp, Chickasha, Okla., in late December (p 42) . . . Power use on systems financed by the Rural Electrification Administration jumped 25% in 1950, according to that agency's year-end estimates (p 43).

ELSEWHERE—Yields on electric utility common stock turned downward in late 1950 and early 1951 as Congress made allowances in the Excess Profits Tax Bill for the industry's peculiar status (p 40) . . . A record for short circuit current was set recently during a series of tests conducted by the General Electric Co and the Bureau of Reclamation at Grand Coulee Dam (p 44) . . . Virginia Electric & Power Co will continue its fight to bring power to the aeronautical laboratories of the National Advisory Committee for Aeronautics at Langley Field, Va. (p 45) . . . The way has been cleared for final dismemberment of Puget Sound Power & Light Co by a state supreme court decision (p 46) . . . And consumption of primary power in Canada topped the 4-billion-kwhr mark for the first time in October, 1950.

• • •

*Washington's ever-active rumor mill is busy moving federal agencies out of Washington. It's pretty definite that SEC will be moved, and FPC is said to be near the head of the list. An unconfirmed report is that space has been procured for FPC in Denver.*

System reserve of the industry at the time of the December peak was 10.8%, according to the Edison Electric Institute. The peak load is estimated at 60,250,019 kw and the capability at the time of peak at 66,767,800 kw.

*The International Bank for Reconstruction and Development has made a $2.6 million loan to Central Hidroelectrica de Caldas, Ltd, a publicly owned power organization, to help defray costs of a new 20,000-kw hydroelectric project in Colombia. The new power project will serve Manizales, a city of 130,000 persons, which now gets its entire power supply from municipal hydro plants with a total capacity of 6,300 kw.*

President Truman will ask the 82nd Congress to remove the 2¢-a-lb tariff on copper.

*Capital expenditures by utilities will continue to climb in 1951, but not so fast as those of other business groups, SEC estimates indicate. Expansion by electric and gas utilities is expected to total $3,440 million, a gain of 7% over the approximately $3,220 million expended in 1950. Total business expansion is expected to reach a record $21.9 billion in 1951, 21% over the $18.1 figure for 1950.*

In both Great Britain and Holland use of electricity for outdoor advertising and street lighting has been restricted because of the shortage of coal.

*Seattle City Light has added an eleventh boat to its "navy." Five of the ships are rounding up floating logs and brush on Ross Lake, above Ross Dam; four are working on Diablo Lake; and one is awaiting the day when excursion parties may again inspect the Skagit project. The new 12-passenger launch will carry engineers and inspectors from Diablo Dam to the Ross Plant upstream. There is no other means of transportation in the narrow Skagit gorge.*

## Notes From The News

A December record of 22,566 persons to visit Hoover Dam on the guided tour boosted the 1950 total to 393,685. This total for the year ranks as the third record high, being surpassed only by the totals established in 1947 and 1948. Top year was '47 . . . Portland General Electric Co's residential customers used an average of more than 5,300 kwhr during 1950, about 300 more than in 1949 and three times the national average . . . With the shout made famous by cowboys all over the west—"Powder River, Let 'Er Buck"—officials of the Hot Springs Electric Association threw the switch which brought power for the first time to the tiny, historic community of Powder River, Wyo. Every last one of the town's 75 residents turned out for the ceremony as the steady power supply began flowing over the newly-constructed REA lines . . . Boston Edison Co generating stations carried the highest peak load in the company's history at 4:45 pm on Dec. 12—565,720 kw.

# Upward Trend of Yields Reversed

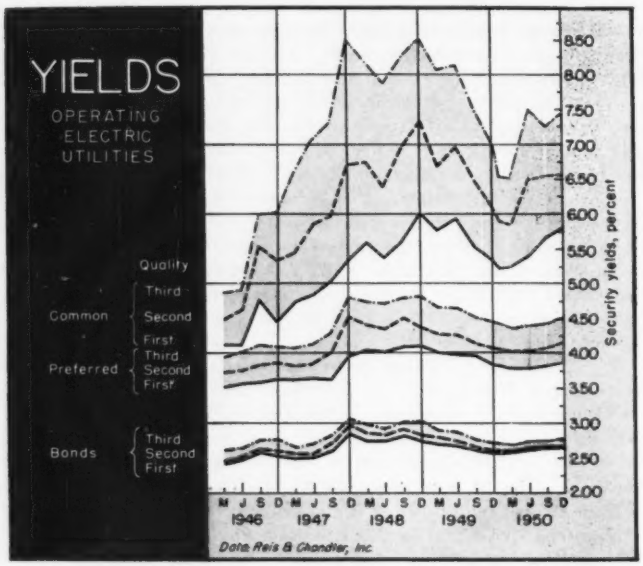
## Market for Electric Utility Common Improving as 1950 Comes to End; Industry's New Money Financing Total 19% Below That of Year Before

Yields on electric utility common stock turned downward in late 1950 and early 1951 as Congress made allowances in the Excess Profits Tax Bill for the industry's peculiar status. This reversal of the quarter's trend held out hope for an easier time this year in financing capacity expansion.

In spite of a high construction budget, 1950 new money financing through public offerings by electric utilities was 19% below 1949's total, $1,032,065,000 last year compared to $1,273,447,000 the year before (See table). After raising more than $700 million in the first half of the year, electrical companies ran into a much tougher market with the start of the Korean war. In the third quarter new money financing dropped to $88,401,000, coming back somewhat to hit $228,230,000 in the final period.

Proportionately, preferred stock financing was a little more popular in 1950 than in 1949. Last year 21% of electric utility new money raised through public offerings came from this source, compared to 16% in 1949. Bonds and common stocks stayed closer to their 1949 relative positions. In 1950 bonds made up 53% of the new money total, compared to 56% the year before; for common stock the figures were 26% and 28%.

A continued trend toward private placement was evident in the bond market. Close to $200 million worth of new money bonds were sold privately to institutional investors last year and nearly $100 million of refunding bonds. Private new money sales of preferred stock totaled at least $27 million, with about $6.5 million for refunding.




**FALL IN YIELDS of electric utility common began in last two weeks of 1950, continues in 1951. Year-end indexes were slightly above those at end of September**

As 1951 began, the common stock market was much brighter for utilities. The Dow-Jones utility stock average on Dec. 28 was 1.4% above its Sept. 28 level and only 6.5% below that of May 25, when yields on electric utility common hit their low for the year.

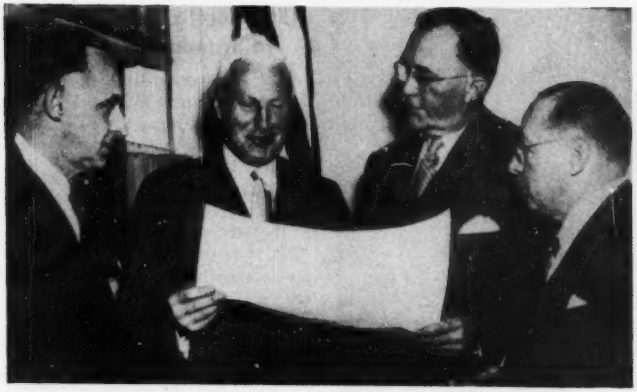
This picture contrasted sharply with that only two weeks before. On Dec. 14 the Dow-Jones utility average was 3.4% below the end of the third quarter and 10.9% below May 25. Prices showed less of a rise from the end of 1949, 5.5% below Dec. 29, 1949, on Dec. 14, 1950 and 0.8% below on Dec. 28.

Reviving utility stocks, however, were far outshone by industrials. The Dow-Jones industrial index on Dec. 28 was 18% above its level of Dec. 29, 1949; 5.8% above May 25, 1950; and 4.2% above Sept. 28. Industrials also spurted up in the last two weeks of the

**Public Offerings**
**Electric Utility Securities**
**(Totals Estimated in Thousands of Dollars)**

| | 1950 | | | 1949 | | |
|---|---|---|---|---|---|---|
| | New Money | Other | Total | New Money | Other | Total |
| Bonds, Notes, and Debentures | 547,063 | 281,387 | 828,450 | 708,297 | 216,790 | 925,087 |
| Preferred Stocks | 214,235 | 76,934 | 291,169 | 209,141 | 7,387 | 216,528 |
| Common Stocks | 270,767 | 96,263 | 367,030 | 356,009 | 126,404 | 482,413 |
| **Total** | 1,032,065 | 454,584 | 1,486,649 | 1,273,447 | 350,581 | 1,624,028 |
| | **First Quarter of 1950** | | | **Second Quarter of 1950** | | |
| Bonds, Notes, and Debentures | 135,250 | 36,500 | 171,750 | 233,500 | 202,200 | 435,700 |
| Preferred Stocks | 61,802 | 30,413 | 92,215 | 81,041 | 44,535 | 125,576 |
| Common Stocks | 127,366 | 25,848 | 153,214 | 76,475 | 46,641 | 123,116 |
| **Total** | 324,418 | 92,761 | 417,179 | 391,016 | 293,376 | 684,392 |
| | **Third Quarter of 1950** | | | **Fourth Quarter of 1950** | | |
| Bonds, Notes, and Debentures | 78,500* | 3,600 | 76,100* | 105,813 | 39,087 | 144,900 |
| Preferred Stocks | 10,878 | ..... | 10,878 | 60,514 | 1,986 | 62,500 |
| Common Stocks | 5,023 | 4,225 | 9,248 | 61,903 | 19,549 | 81,452 |
| **Total** | 88,401 | 7,825 | 96,226 | 228,230 | 60,622 | 288,852 |

* Adjusted.



**WILLIAM H. HARRISON, recently appointed head of a new Defense Production Administration, is shown with top mobilization officials. Left to right are Gen Lucius Clay, Harrison, Charles E. Wilson, and Sidney Weinberg. Wilson is head of Office of Defense Mobilization, and Clay and Weinberg are his assistants**

year, rising more than 4% between Dec. 14 and Dec. 28.

Market movements were clearly reflected in year-end utility yields. Electrical World's index of first quality operating electric utility common stock stood at 5.80 on Dec. 28 (See chart), compared to the year's high of 6.04 on Dec. 14 and the year's low of 5.01 on May 25. This was well above the level (5.37) for the final week of 1949 and slightly above the last week of the third quarter, 5.70.

Dec. 28's 5.80 figure, however, was the highest end-of-quarter yield index since June 1949 when the index read 5.94, and was not far below the five-year end-of-quarter high, the 6.01 hit at the end of December 1948.

The downward trend continued in the first week of 1951. The first quality common yield index dropped .13 points to 5.67 on Jan. 4, a low since mid-October. Second and third quality common yield indexes followed the first quality movement. Spreads among the various grades were almost unchanged in 1950.

Dividends, the other component of the yield ratio, rose in 1950. Forty companies increased them, and only one made a decrease. The last quarter saw 13 dividend boosts, including four year-end extras. The single decrease came in the first quarter. The third quarter showed but four increases.

Preferred stock yields in 1950 were much more stable than those of the fluctuating common. At the end of December first quality preferreds were yielding 3.86, compared to 3.81 at the end of September and 3.85 at the end of 1949.

Trend for the year was downward until the Korean war began and since then has been slightly upward. Preferred yields have been relatively favorable to utilities over the last five years. Though somewhat higher now than in the balmy days of 1946 and 1947, when insurance companies were aggressive buyers, they still are well below the end of September, 1948, high of 4.19.

Bond yields also inched upward last year, following the pattern of government bonds.

Issues convertible into common stock lost favor in 1950. No convertible debentures were offered to the public last year and only one small issue of convertible preferred stock. In 1949 four issues of convertible debentures brought in more than $76 million, and close to $23.5 million was raised through five offerings of convertible preferred.

For the electric utilities 1950 also was a year of consolidation as a number of small companies were absorbed by larger utilities. Southern Co took over Birmingham Electric Co for ultimate merger with Alabama Power Co, and Michigan Public Service Co was merged into Consumers Power Co. Currently under way are absorption of Central Louisiana Electric Co by Gulf Public Service Co, and Central Ohio Light & Power Co by the American Gas & Electric Co system.

## TVA Starts Construction of 2 Big Steam Plants

The Tennessee Valley Authority announced in Knoxville Jan. 8 that construction will get underway immediately on two giant new steam plants. The announcement followed signing by President Truman of a supplemental appropriation bill containing funds to begin the new construction.

The new projects are:

Paducah Plant, to be located 15 miles south of Paducah, Ky., on the Ohio River, will supply half of the 850,000-kw load at the new Atomic Energy Commission uranium separation plant near Paducah (EW, Dec. 25, p 11).

Swan's Pond Plant, two miles from Kingston, Tenn., is being built to meet load growth on the eastern end of TVA's system (EW, Dec. 25, p 6).

The new plants, described as almost identical, will each have four units of 150,000 kw capability, or a total at each plant of 600,000 kw capability. Each plant will occupy a site of about 250 acres.

Total cost of the Paducah plant is estimated at $88.5 million, while Swan's pond will cost $85 million.

Foundation drilling is now underway at the Paducah site and grading is scheduled to start soon. Drilling is continuing at Swan's Pond.

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## 40,000-Kw Unit Planned

Florida Power Corp will install a 40,000-kw unit at its new Booth Point Plant near Oldsmar. Installation is expected to be completed in 1954. The first of three 40,000-kw units of the plant is scheduled for initial operation in May. The utility has also ordered a 20,000-kw unit which will be installed on the system of the Georgia Power & Light Co, a subsidiary of Florida Power.

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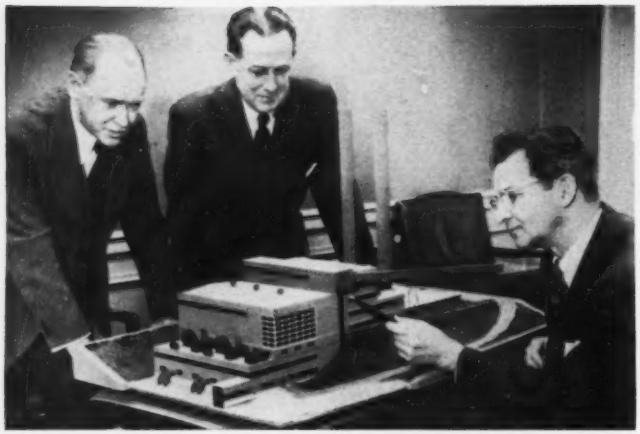
## Will Add 99,000-Kw Unit

Kansas City Power & Light Co will install a 99,000-kw steam generating unit at its Hawthorn Plant. Completion of the installation is scheduled for April 1953. The unit will add 75% to the 132,000-kw capacity of two units presently under construction.



**SCANNING a model of Cleveland Electric Illuminating Co's Eastlake power plant are, left to right, D. C. Ober, executive vice president; A. A. Casey, general superintendent of steam power; and C. A. Dauber, mechanical engineer. Initial installation calls for two 125,000-kw units with ultimate capacity of 1 million kw**

# Energy for Defense and Materials for Expansion Defense Power Job

Getting power for defense needs and materials for expansion of utility generating capacity are the big jobs of the Defense Power Administration, according to its new administrator.

Clifford B. McManus, president of Georgia Power Co and the Southern Co, was sworn in as Defense Power Administrator Jan. 4 in the office of Interior Secretary Oscar L. Chapman. Nearly 100 persons, including Defense Power consultants, Interior power personnel, and newsmen, attended the brief ceremony.

McManus summed up his new job as one of getting the materials and equipment to make more power available for defense.

"As far as Defense Power Administration is concerned," he said, "there is no difference between private and public power."

The new Defense Power Administrator indicated that Defense Power would not be affected by the establishment of the new Defense Production Administration under Charles E. Wilson's Office of Defense Mobilization. There was authoritative speculation in the capital, however, that Defense Power's days in the Department of Interior were numbered. Power and perhaps other Interior defense agencies were expected to be separated from the department within the coming weeks or months.

One of McManus' first tasks was organization of Defense Power. He said that other consultants named by Secretary Chapman would be continued. Staff positions have not been filled on anything but a temporary basis, pending selection of the administrator who must fill the jobs. D. L. Marlett, assistant administrator of the Bonneville Power Administration and acting Defense Power chief until McManus took over, plans to return to BPA later this month.

Meanwhile, Defense Power is getting statements of proposed construction projects and uses of aluminum, copper and copper-base alloy by electric utilities. Also being compiled are returns from the earlier survey to obtain estimates on use of copper, aluminum, and steel during the last three quarters of this year. From these reports, Defense Power will prepare estimates of total industry needs for submission soon to the National Production Authority. These data will give NPA firm figures on which to base future materials allocations.

## RFC Mobilization Loan to Standard Sets Pattern

The first money loaned to industry by the government to help the mobilization is now being spent. Reconstruction Finance Corporation made the first loan, $775,000, to the Standard Cable Corp, Chickasha, Okla., in late December.

The terms of the loan give an indication of what kind of aid the government is thinking about in ladling out the $600 million Congress directed RFC to lend as well as the $1.4 billion Congress authorized so long as RFC will come to Congress and get the money in an appropriation.

Standard Cable has military orders to turn out insulated wire, cable, and cord sets. It will place the loan in a revolving fund from which to draw for machinery and equipment and working capital. The loan is for nine months at 5% interest.

It is significant that the mobilization loan was made on certification from the Commerce Department that Standard Cable is necessary to rearmament. Previously RFC had turned down the firm's request for a straight business loan of about $2 million. RFC found that the company did not have sufficient collateral to back up a 5% business loan.

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## Britain Restricts Use of Zinc, Copper, Brass

British use of zinc, copper, and brass in the manufacture of a wide range of consumer goods has been prohibited, effective Feb. 1.

The list of prohibited uses includes architectural and decorative metal work, household appliances, domestic utensils, and ornamental articles. Some 600 direct users of zinc and about 2,000 firms that take copper directly from the Ministry of Supply are affected. The government also plans to recontrol soon the price and supply of scrap zinc, copper, and lead.

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## 70,000-Kw Unit Planned

Central Illinois Public Service Co will install a second 70,000-kw unit at its Hutsonville Plant. Installation is expected to be completed some time in 1953.

**AT HUNGRY HORSE DAM** erection of the structural steel framework for the powerhouse is continuing through the winter. First power and flood control benefits from the dam will be available to Montana and the Pacific Northwest in 1952

# Power Use on Systems Financed by REA Show Gain of 25% in 1950

Power use on systems financed by the Rural Electrification Administration jumped 25% in 1950. REA's year-end estimates placed total power sales by borrowers at 7.8 billion kwhr, compared with total sales of 6,227,471,179 kwhr in 1949. The gain, 1,573 million kwhr, was more than the total figure for 1941.

In addition to growing numbers of rural consumers, power use on the farm is also increasing, REA reported. Studies showed a 500% gain in annual power use over a decade by representative groups of rural consumers.

During 1950, REA borrowers added 380,000 consumers, or a rate of 1,462 new consumers connected during each working day in the year. As of Dec. 31, REA estimated that 3,420,000 consumers were connected to 1,091,000 miles of line operated by its borrowers. REA has made loans to 1,007 systems.

A total of 96 REA-financed systems operated generating plants with a total capacity of 396,000 kw.

Since 1935, REA has approved loans totaling $2.3 billion. Of this sum, $1,872 million has been for distribution lines, $409 million for generation and transmission facilities and $19 million for consumer facilities. Funds actually advanced reached $1,706,500,000.

Debt service payments by borrowers were estimated at $266.5 million, $160.6 million in principal and $105.9 million interest. Principal due was $135.3 million and interest due, $106.2 million.

A total of $775,000, or three-tenths of 1% of the amount due, was more than 30 days in arrears. This included $550,000 of principal and $225,000 of interest. Advance payments of principal were $26 million, or 10% of the amount due.

Total system input by REA borrowers during 1950 was 9,251 million kwhr, of which 1,108 million kwhr was generated by the borrowers and 8,143 million kwhr was purchased. Cost of power purchased was $79 million.

In REA's new rural telephone loan program, 60 borrowers were approved for loans totaling $19 million during 1950. Phone borrowers were from 23 states and included 40 commercial companies and 20 cooperatives.

The phone program did not really get going until the middle of the year so it should grow in '51.

## Pittsburgh to Modernize School Building Lighting

Pittsburgh will spend $100,000 a year for the next ten years to modernize the lighting in the city's 119 school buildings. Work in two of the buildings has been completed.

The standard fixture is semi-direct consisting of ballast channel and louvers. The integral louvers and side shields are easily removable in one piece for dunking in tank detergent and rinsing. Lamps are either 75 w or 40 w 425 MA slimline. Fixtures are the two-lamp type. The typical classroom has three rows of fixtures. Each row consists of three 75-w and a 40-w fixture. These provide an approximate level of 35 ftc in service, with satisfactory low-brightness factors. Some buildings now have only 5 to 15 ftc.

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## N. Y. Utility Boosts Wages

Niagara Mohawk Power Corp will increase wages of its employees 6% between now and June 3. The agreement, which came as a result of a voluntary wage discussion between labor and management, provides for a 3% boost in pay effective the first of this year. The workers will receive another 3% raise on June 3. The present contract was extended one year to May 31, 1952.

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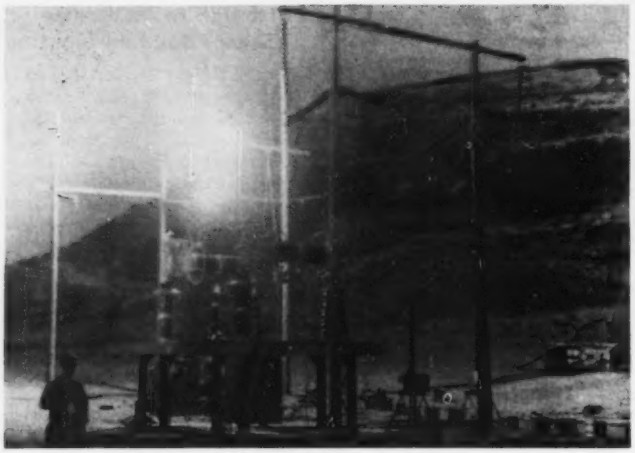
## Educational Film Made

A 30-minute educational film showing development of the Salt River Valley Project and reclamation in the West has been produced by the Salt River Valley Water Users Association. The movie will be distributed to schools and civic organizations as an educational service.

•

## Plans $19-Million Expansion

Florida Power & Light Co plans to spend about $19 million for construction during the coming year. Key project of the company will be a new 75,000-kw plant on the lower east coast of Florida. Plans have also been formulated for completion of the 33,000-kw plant at Palatka. Since 1945 the generating capacity of the company has more than doubled.



ARC illuminates the countryside during circuit breaker tests at Grand Coulee

## Short Circuit Tests Set Record at Grand Coulee

A record for short circuit current was set recently during a series of tests conducted by the General Electric Co and the Bureau of Reclamation at Grand Coulee Dam. The tests were made on a single-pole unit of one of the thirteen 10 million-kva, 230-kv low-oil-content, impulse-type oil circuit breakers now installed in the Right Switchyard of the Grand Coulee project.

The generating capacity of twelve of the fourteen 108,000-kw generators at Grand Coulee plus the available capacity of other stations of the Northwest Power Pool were thrown into the tests to produce the largest value of short circuit current ever recorded—the equivalent of 12 million-kva symmetrical three phase.

Even this enormous amount of short circuit current was interrupted by the 10 million-kva circuit breaker unit within its rated interrupting time of 3 cycles without any sign of distress whatsoever.

A total of 12 interrupting and 24 line dropping tests were made, all of which were entirely successful. The interrupting tests ranged from 5 million to 12 million kva and four of them, ranging from 6 million to 9 million kva were high speed reclosing tests with reclosing times between 8.75 and 9.2 cycles. The line dropping tests, all of which were accomplished without the occurrence of a single restrike, were made with from 100 to 300 miles of 230-kv transmission line.

The test breaker was not opened for inspection or part replacement during the entire series of tests, but careful inspection afterward revealed that all parts of the breaker were in condition to continue under normal operation.

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## Kentucky PSC OK's REA Loan to Co-op

Kentucky Public Service Commission last month approved one of the Rural Electrification Administration's larger generating and transmission loans.

PSC granted a certificate of convenience and necessity to the East Kentucky Electric Cooperative Corporation, Danville, Ky., for the construction of a 40,000-kw steam plant at Ford, Ky., and a 597-mile network of 69-kv transmission line. The program is being financed by REA loans of more than $12 million, approved by the federal agency more than a year ago.

The super co-op's system will be interconnected with TVA.

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## 60,000-Kw Plant Planned

Northern States Power Co will build a 60,000-kw plant on the Minnesota River south of the Twin Cities. First units of the plant are expected to be completed in September 1952.

## October Energy Sales Up 20.3% Over 1949

Sales of electrical energy in October were 20.3% above those for the same month last year.

Electric utilities in October sold 24,430,996,000 kwhr to ultimate customers, compared to 20,308,694,000 kwhr in October, 1949. Revenue from ultimate customers totaled $435,281,900, which was 13.6% more than the $383,236,200 received in the same month the year before.

**Classification of Sales, October**

| | Million Kwhr 1950 | 1949 | Percent Change |
|---|---|---|---|
| Residential or domestic | 5,482 | 4,749 | +15.4 |
| Rural (distinct rural rates) | 631 | 626 | + 0.9 |
| Commercial or industrial | | | |
| Small light and power | 4,321 | 3,876 | +11.5 |
| Large light and power | 12,584 | 9,709 | +29.6 |
| Street and highway lighting | 280 | 251 | +11.9 |
| Other public authorities | 613 | 581 | + 5.5 |
| Railways and railroads | | | |
| Street and interurban railways | 279 | 289 | − 3.2 |
| Electrified steam railroads | 197 | 182 | + 8.5 |
| Interdepartmental | 42 | 46 | − 9.3 |
| Total to ultimate customers | 24,431 | 20,309 | +20.3 |

For the 12 months ended Oct. 31 usage per customer was up 8.2%, from 1,664 kwhr in the 12 months ended Oct. 31, 1949, to 1,801 kwhr. Average annual bill amounted to $52.23, or 6.1% above the previous year's $49.25. Revenue per kilowatt-hour declined 2%, from 2.96¢ to 2.90¢.

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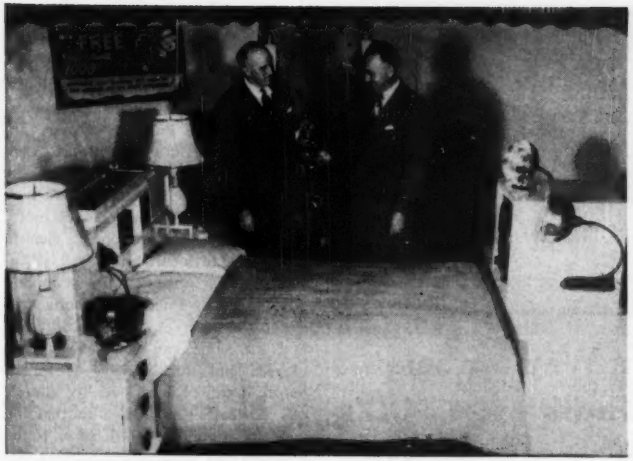
## Operating Revenues Up 13.2% over October, 1949

Electric utility operating revenues in October were 13.2% above those for the same month a year ago, the Federal Power Commission reports.

A figure of $408,607,000 was reported for electric operating revenues of the Class A and B electric utilities in the United States in October. This compares to $360,836,000 in October, 1949.

Net income was up 6.2% to $58,693,000 from the $55,290,000 reported for October, 1949. Revenue deductions (including operating expenses, depreciation, and taxes) were $330,262,000 or 14.5% over those of October, 1949. Gross income, including other utility operating income, amounted to $81,336,000, an increase of 5.7% for the month.



**BUILT-IN-TELEVISION, an electric bed covering, and ten other electrical appliances supplied the magic for this $1,000, custom-built bed which was the outstanding feature at 13th annual show of San Diego Bureau of Home Appliances**

## Texas Utilities Granted Extension of Interties

The Federal Power Commission on Dec 29 granted a two-year extension of emergency interconnections by five electric utility systems in Texas.

Extension of time for maintenance and emergency use of the interconnections brought a dissent from Commissioner Thomas C. Buchanan.

The emergency interconnections were first approved on Feb. 7, 1949 to continue to Dec. 31, 1950. Last Dec. 4 the companies asked that FPC permission be extended two more years. By obtaining FPC approval for emergency interconnections, the companies may make the power links without affecting their jurisdictional status under the Federal Power Act.

In approving the extension to Dec. 31, 1952 FPC noted President Truman's declaration of a national emergency. Approval, it was stated, would insure that the companies "will be in the best possible position to adequately and continuously serve existing and potential defense loads, including military establishments, in the area in which they serve . . ."

Commissioner Buchanan said that the proclamation of a national emergency did not create a power shortage in the area served by the companies. He contended that the interconnections are "permanent in their nature" rather than "of any emergency character." If the companies voluntarily severed the interconnections, Buchanan argued, "such action would harm no one but the applicant companies, certainly not the war effort."

The interconnections that have been granted the emergency extension are:

Texas Electric Service Co with West Texas Utilities Co near Eskota, McCamey, Sterling City, Cisco, Brownwood, Holliday, and Munday; and with Southwestern Public Service Co near Denver City.

Texas Power & Light Co with Southwestern Gas & Electric Co near Overton, Edgewood, and Swan; with Southwestern Power Administration at Payne Substation near Denison; and with the Lower Colorado River Authority near Minerva, Round Rock, and Lampasas.

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## 240,000 Kw Being Added

Niagara Mohawk Power Corp is installing two 80,000-kw steam units in its Charles R. Huntley Plant at Buffalo, N. Y. and another of the same size in its plant at Albany. All three units are scheduled to go into operation in 1953. These additions will bring the capacity of the Buffalo plant to 785,000 kw and Albany to 240,000 kw. The utility's total capacity will reach 2,862,000 kw in 1953 with the completion of these units and others now in the planning stage.

## NLRB Ruling Upholds General Electric Co

Expressing preference for dealing directly with employees is not an unfair labor practice under the Taft-Hartley Law. This is the decision of the National Labor Relations Board in a case involving General Electric Co's insulation plant at Anaheim, Cal.

When the United Electrical Workers lost a representation election on a tie vote of the 18 employees, it filed an unfair labor practice charge and asked the NLRB to throw out the election.

The board not only refused but reversed a decision of the regional director who had ruled that a pre-election letter from the GE management to the employees illegally promised benefits.

The board found that GE's letter did not interfere with the election by preventing free choice by the workers. The letter merely repeated the company's preference for direct dealings with the workers, the board said. Also, the letter stated that relations would still be friendly, and there would be no penalty if the union won.

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## Vepco to Continue Fight to Serve NACA Project

Virginia Electric & Power Co will continue its fight to supply power to the aeronautical laboratories of the National Advisory Committee for Aeronautics at Langley Field, Va. The 81st Congress in its closing hours appropriated funds to the Southeastern Power Administration to build a transmission line from the Buggs Island project on the Roanoke River to the field (EW, Jan. 8, p 5).

Vepco hopes to be able to supply power to the installation over its own lines or else to be allowed to "wheel" government power to the NACA project. The utility is in a position to supply power at an earlier date.

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## Diesel Purchase Okayed

The City Council of Bluffton, Ind., has authorized purchase of a 2,500-kw diesel generator for the municipal power plant. The city plant now has two 1,000-kw diesels in operation. Bluffton also has a steam plant of 3,000-kw capacity.

**YIELDS (%) — Operating Electric Utility Securities**

| | Bonds | | | Preferred Stocks | | | Common Stocks | | |
|---|---|---|---|---|---|---|---|---|---|
| Quality | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 1st | 2nd | 3rd |
| DATE | | | | | | | | | |
| 1950 | | | | | | | | | |
| Jan. 4 | 2.64 | 2.67 | 2.77 | 3.84 | 4.09 | 4.50 | 5.67 | 6.45 | 7.39 |
| Dec. 28 | 2.65 | 2.67 | 2.78 | 3.86 | 4.14 | 4.51 | 5.80 | 6.54 | 7.44 |
| END OF QTR. | | | | | | | | | |
| 4th 1950 | 2.65 | 2.67 | 2.78 | 3.86 | 4.14 | 4.51 | 5.80 | 6.54 | 7.44 |
| 3rd 1950 | 2.66 | 2.67 | 2.76 | 3.81 | 4.08 | 4.46 | 5.70 | 6.54 | 7.25 |
| 2nd 1950 | 2.68 | 2.66 | 2.74 | 3.79 | 4.03 | 4.38 | 5.38 | 6.51 | 7.50 |
| 1st 1950 | 2.59 | 2.61 | 2.74 | 3.78 | 4.01 | 4.36 | 5.22 | 5.85 | 6.67 |

Data: Reis & Chandler, Inc.

# Court Decision Clears Way for Sale of Puget Power Facilities to PUD's

The way has been cleared for final dismemberment of Puget Sound Power & Light Co by a state supreme court decision upholding constitutionality of Washington's 1949 power law permitting two or more public utility districts to join in purchasing private utility properties.

Thurston County PUD and other PUD's in the state now are free to go ahead with purchase of all Puget Sound P&L properties except those within or adjacent to the city of Seattle, which the city expects to take over. An estimated $95 million is involved.

Since the law not only permits the PUD purchase but also sets up a state power commission, its constitutionality had been attacked on the grounds an act can deal with only one subject. The court minority opinion upheld this line of reasoning, but six of the nine judges declared it "very clear" that the act does not violate the state constitution since "Every one of its 17 numbered subdivisions deals with matters cognate to the general subject. 'the state's electrical resources.'" Judge E. W. Schwellenbach, in a dissent, described the part of the act creating a state power commission as "a preamble to the Washington substitute for a Columbia Valley Authority."

The PUD's now will be "able to proceed in an orderly acquisition of the company's property," after which they will "modernize the system and cooperate to develop new generation," John P. McCauley, executive secretary of the State Association of PUD Commissioners, said.

The price to be paid, he reported, will be adequate to retire all stocks, bank notes, and other liabilities of the company and give the stockholder about $18 a share. News of the decision sent Puget Power stock up almost two points to 17⅝. The PUD bond issue also will include 10% additional working capital, cost of financing, engineering, and a commission of ½% for the fiscal agent and liquidation expenses.

The original plan was for seven PUD's to buy all facilities of the company. Since then, however, some properties have been disposed of piecemeal, such as in Snohomish and Island Counties to the Snohomish PUD, and others have been tied up in condemnation. Some of the nine condemnation actions were brought by PUD's and may be withdrawn, but others were brought by cities, such as Tacoma, and agreement may be more difficult in those instances. Several small cities in the Puget Sound area are seeking to condemn distribution facilities within their limits while Tacoma and several PUD's want the same generating facilities. All the company's major hydroelectric plants, with a capability of about 225,000 kw, are at issue.

Frank McLaughlin, president of Puget Power, expressed hope that "this decision is not too late to enable a constructive solution of the critical power problem in the company's service area. As a result of the obstructionist tactics as to overall acquisition and the conflicts of interest between various public agencies, the power situation in Puget's service area has become unbelievably chaotic and entangled."

Referring to the condemnation actions that involve about 50% of Puget's revenue and customers, exclusive of the Seattle area, McLaughlin commented that "such a piecemeal chopping up of Puget's system is fantastic and tragic under present conditions, where power economics, the national defense program, and high labor and material costs demand more, and not less, integration of electric facilities. Obviously an overall acquisition, which preserves the economic advantages of Puget's interconnected system, best serves the public interest and the same can be said for employees and stockholders. However, before it can become a reality numerous obstacles—such as the pending condemnation suits—will have to be removed and the conflicts between opposing public power groups resolved."

Agreement has been reached for the sale of Seattle properties for $25,850,000 to the city of Seattle, but the final sale has been held up pending a recount of the referendum vote on the question in the November election (EW, Jan. 1, p 44). Apparently the purchase was approved by a slim margin.

Gov Arthur B. Langlie delayed naming members to the state power commission until the law should be validated. He is expected to make these appointments soon.

The law also enables PUD's to make payments to school districts in lieu of taxes that would have been paid by privately owned utilities.

## FINANCIAL BRIEFS

**The United States Supreme Court** has refused to hear an appeal by Consolidated Gas, Electric Light & Power Co of Baltimore from a lower court decision outlawing the agreement under which it buys power from Pennsylvania Water & Power Co. The Fourth Circuit Court of Appeals held that the contract between the two companies violated federal anti-trust laws (EW, Oct. 9, p 86).

**For the first time** since 1892 the Niles, Ohio, municipal water and light department is out of debt, Bert Holloway, superintendent, reports. Holloway has supervised the system since 1903.

## Canadian Primary Usage Hits 4-Billion-Kwhr Mark

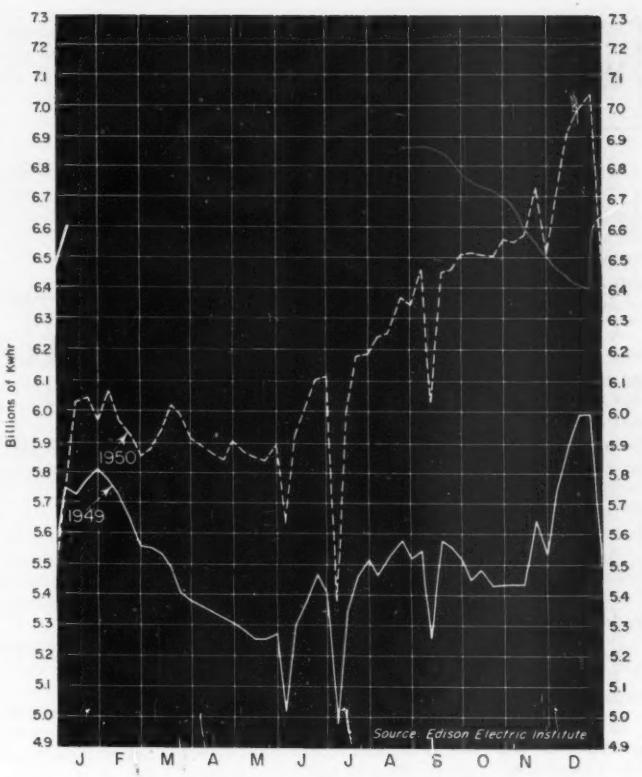
Consumption of primary power in Canada topped the 4-billion-kwhr mark for the first time in October 1950. The new record was brought about by the growing demand for industrial power as the Dominion mobilizes. It was the twentieth month in a row that primary-power usage exceeded that of the same month a year previous.

As in the United States, power consumption has been rising sharply since the outbreak of the Korean trouble. The trend earlier in 1950 for secondary power to increase has been reversed. There will have been less secondary power available in 1950 than in 1949.

Production of energy during 1950 also increased sharply. All indications are that the 50-billion kwhr mark was passed for the first time. The 1949 total was 46,673,214,000 kwhr, the 1948 total 44,568,849,000 kwhr.

The following statistics supplied by the Dominion Bureau of Statistics are in thousands of kilowatt hours:

| Period | 1950 | 1949 |
|---|---|---|
| Ten Months' Output | 41,685,990 | 38,718,937 |
| Primary | 38,903,146 | 35,901,801 |
| Secondary | 2,782,844 | 2,817,136 |
| Primary Consumption | 37,616,745 | 34,726,286 |
| Net Exports to U. S. | 1,603,218 | 1,531,073 |
| October Output | 4,384,531 | 3,975,153 |
| Primary | 4,223,841 | 3,734,711 |
| Secondary | 160,690 | 240,442 |
| Primary Consumption | 4,092,126 | 3,627,613 |
| Net Exports to U. S. | 139,509 | 119,475 |
| September Output | 4,113,216 | 3,753,055 |
| Primary | 3,975,163 | 3,609,125 |
| Secondary | 138,053 | 143,930 |
| Primary Consumption | 3,843,357 | 3,495,738 |
| Net Exports to U. S. | 142,839 | 119,614 |




## Output Week Ended Jan. 6—6,602,122,000 Kwhr

**Weekly Output, Millions Kwhr**

| 1951 | | 1950 | | 1949 | |
|---|---|---|---|---|---|
| Jan 6 | 6,602 | Jan 7 | 5,695 | Jan 8 | 5,742 |
| 1950 | | 1949 | | 1948 | |
| Dec 30 | 6,479 | Dec 31 | 5,493 | Jan 1 | 5,562 |
| Dec 23 | 7,033 | Dec 24 | 5,994 | Dec 25 | 5,508 |
| Dec 16 | 6,985 | Dec 17 | 5,997 | Dec 18 | 5,790 |
| Dec 9 | 6,909 | Dec 10 | 5,881 | Dec 11 | 5,705 |
| Dec 2 | 6,716 | Dec 3 | 5,743 | Dec 4 | 5,646 |
| Nov 25 | 6,508 | Nov 26 | 5,537 | Nov 27 | 5,349 |
| Nov 18 | 6,728 | Nov 19 | 5,644 | Nov 20 | 5,627 |
| Nov 11 | 6,574 | Nov 12 | 5,435 | Nov 13 | 5,571 |
| Nov 4 | 6,551 | Nov 5 | 5,435 | Nov 6 | 5,564 |

**Percent Change from Previous Year**

| | Jan 6 | Dec 30 | Dec. 23 |
|---|---|---|---|
| New England | +13.0 | +17.9 | +12.7 |
| Mid-Atlantic | +15.5 | +18.2 | +16.7 |
| Central Industrial | +11.6 | +18.7 | +18.0 |
| West Central | +13.4 | +12.9 | +13.5 |
| Southeast | +25.1 | +23.0 | +28.2 |
| South Central | +19.6 | +19.9 | +20.9 |
| Rocky Mountain | + 8.5 | +12.4 | +10.5 |
| Pacific Coast | + 8.6 | +13.6 | + 8.8 |
| Total United States | +15.9 | +18.0 | +17.3 |

## MEETINGS

**Public Information Program**
Mid-Atlantic Regional Meeting, Hotel Hershey, Hershey, Pa., January 12.

**Edison Electric Institute**
Accident Prevention Committee, Lord Baltimore Hotel, Baltimore, Md., January 15-16; Commercial Cooking Committee, Conference Room, Potomac Electric Power Co., Washington, D. C., January 15-16; Electrical Equipment Committee, Hotel Cleveland, Cleveland, Ohio, February 12-13; Transmission and Distribution Committee, Atlanta Biltmore Hotel, Atlanta, Ga., February 15-16; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 2-5.

**American Institute of Electrical Engineers**
Winter General Meeting, Hotel Statler, New York, January 22-26; District No. 4 Meeting, McFadden-Deauville Hotel, Miami, Fla., April 11-13.

**National Rural Electric Cooperative Association**
Annual Meeting, Cleveland Municipal Auditorium, Cleveland, Ohio, January 29-February 1.

**Pennsylvania Electric Association**
Transmission and Distribution Committee, William Penn Hotel, Pittsburgh, February 1-2; Hydraulic Power Committee, Benjamin Franklin Hotel, Philadelphia, February 8-9; Electrical Equipment Committee, Hotel Emerson, Baltimore, Md., March 1-2; Prime Movers Committee, Berkshire Hotel, Reading, Pa., March 8-9.

**Missouri Valley Electric Association**
Industrial and Commercial Sales Conference, President Hotel, Kansas City, Missouri, February 8-9; Engineering Conference, President Hotel, Kansas City, Mo., April 4-6.

**Adequate Wiring Bureau**
Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, February 15-16.

**★Public Utility Buyers' Group of the National Association of Purchasing Agents**
William Penn Hotel, Pittsburgh, Pa., February 18-20.

**North Central Electrical Association**
Electrical Industries Convention, Nicollet Hotel, Minneapolis, February 25-28.

**National Electrical Manufacturers Association**
Annual Meeting, Edgewater Beach Hotel, Chicago, Ill., March 12-15.

**National Association of Corrosion Engineers**
Conference and Exhibition, Hotel Statler, New York, March 13-16.

**Protective Relay Engineers**
Annual Conference, Agricultural & Mechanical College of Texas, College Station, Texas, March 26-28.

**Oklahoma Utilities Association**
Annual Convention, Mayo Hotel, Tulsa, Oklahoma, March 29-30.

**★Southeastern Electric Exchange**
Engineering and Operation Section, Vinoy Park Hotel, St. Petersburg, Fla., March 29-30.

**American Society of Mechanical Engineers**
Spring Meeting, Atlanta Biltmore Hotel, Atlanta, Ga., April 2-5.

**Electric Association of Chicago**
Industrial Electrical Exposition, Sherman Hotel, Chicago, Ill., April 2-7.

**Midwest Power Conference**
Sherman Hotel, Chicago, April 4-6.

**Northwest Electric Light & Power Association**
Engineering Section, Hotel Utah, Salt Lake City, Utah, April 25-27.

★ Addition This Week

# WASHINGTON COMMENT

RONALD D. ROSS

Without venturing into the uncertain realms of prophecy, it's safe to say that Washington in 1951 is going to play a much bigger role than in 1950 in the operations of the electric utilities—as well as in the lives of all Americans. Despite this growing government interference with private activity, there are signs that the new year may hold some promise of better things for the electric utility industry.

A fully regimented economy may be coming. That's what the statements of Congressmen and the growth of defense agencies add up to. Controls have been a question only of degree since the invasion of South Korea, and strengthening them may well be a good thing for the electric utilities. It had already become apparent that hit-or-miss, piece-meal orders covering critical supplies of metals were not going to assure the orderly expansion of the nation's electric generating capacity. More complete wartime controls will give the expansion of the industry rating as a vital production weapon rather than simply a non-military, non-DO operation.

### Wilson's Appointment Should Aid Utilities

Naming of General Electric Co's Charles E. Wilson as control boss seems to assure that the importance of electric power development will not be ignored.

In his last appearance in the capital before taking over as head of the new Office of Defense Mobilization, Wilson talked about power supply. What he said boiled down to this: We'll have plenty of power if the government doesn't interfere with the presently planned expansion program of the electric utilities. In today's controls picture, Wilson now is in a position to see that the industry's program is not blocked.

Swearing in of an industry executive as administrator of the Defense Power Administration on Jan. 4 is another encouraging development. It's true that C. B. McManus' public statements on federal power have not always agreed with the views of many other industry leaders, but there is a more important fact: Defense Power is now headed by a capable and experienced leader from the privately owned electric power business.

### New Congress Is Not "Fair Deal"

Another side of Washington, too, offers more promise for the electric utilities in 1951. The new 82nd Congress is certain to be even less easily swayed toward "Fair Deal" measures than its predecessor with which the President had more than a little difficulty. It will mean tougher sledding for the federal power planners at Interior and elsewhere in the capital.

In its dying moments, the 81st Congress Jan. 2, gave Interior a sneak preview of trouble ahead. Funds for Southeastern Power Administration's first transmission line, between Buggs Island and Langley Field, were approved only by a close vote of 43-41. Supporting the federal power appropriation were several senators who will not be voting on power issues in the new Congress. These "lame ducks" included Senators Glen Taylor of Idaho, Claude Pepper of Florida, and Scott Lucas of Illinois. Without their votes, the new federal transmission line would have lost.

With businessmen moving into controls posts and a new Congress to deal with federal power expansion, the electric utility industry can expect to find Washington more friendly in 1951.

# TECHNICAL NOTES

ARCHER E. KNOWLTON

**Unit plant economies** can be offset by the larger system reserves required to meet the increased risk of multiple outages.

**Corrosion** of iron and steel by circulating water or brine can apparently be prevented by dissolving a few hundred ppm of sodium and potassium tungstate and sodium and potassium molybdenate in the water.

**Complete separation** of ac and dc control circuits in power stations is getting to be viewed as an unwarranted outlay.

**Most economically operable** power station is not necessarily the most economical to add to a system at a given time and place.

**Voltage complaints** are occasionally attributable to large errors in the indications of voltmeters carried by television service men.

**Unit plant advocates** assert simultaneous loss of boiler of one unit and turbine of another is an improbable occurrence considering today's inbuilt reliability.

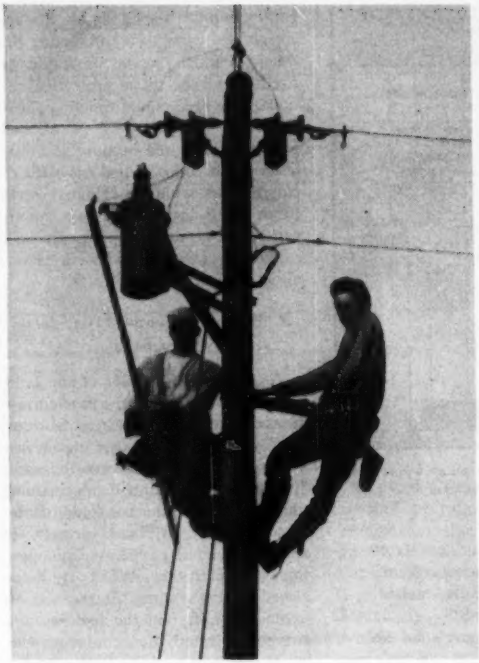
**Monel tanks** are being tried out by one utility as an alternative to cast iron for network and vault transformers.

**Flow-coatings** in three different superposed colors help tell whether a transformer case is being exposed gradually to corrosion. They can be applied to network transformers carrying load.

**Atomic pile** structural materials must neither act as neutron blotters and thus vitiate the fission process nor be disintegrated by the neutron bombardment.

**Turbogenerators** in the largest economically justifiable ratings warrant added expenditures for insulation, instrumentation, sequential soot-blowing, cranes, supplementary valves and good working space for maintenance.

**Short-circuit capacity** must be 100 times the kva rating of 3-phase arc furnaces to hold the characteristic flicker to 1½ v on 115-v service.



RECLOSER INSTALLATION being completed on a rural distribution system will yield savings in restoration expense

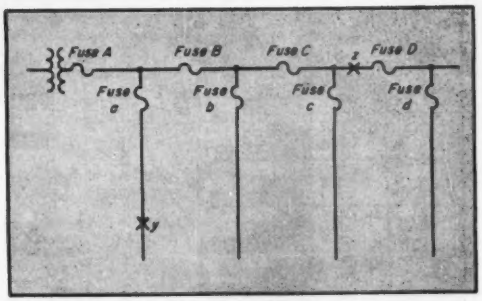



FIG 1—BASIC CIRCUIT for conventional fuse-to-fuse coordination will isolate faults to limit extent of outages

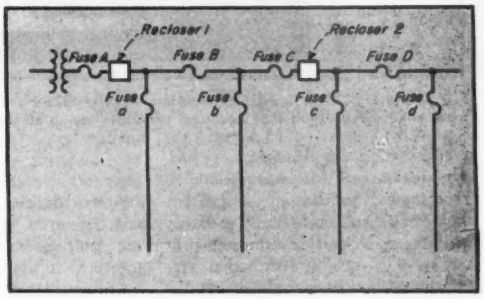



FIG 2—HOLD-CLOSED RECLOSERS and fuses applied to a typical distribution circuit offer several advantages

# Hold Closed—A New Function For Automatic Reclosers

**Properly coordinated with fuses, the hold-closed recloser brings to distribution systems quick clearing of transient faults, isolation of persistent faults, and reduction of restoration cost. Their application and performance is told here**

R. A. BRANFLICK, Distribution Engineer
General Electric Co, Pittsfield, Mass.

Automatic oil circuit reclosers are widely recognized today for their ability to prevent transient faults from causing sustained outages. While reclosers are also used to limit the extent of unavoidable outages, they cannot usually be justified on this basis alone. This secondary function often can be performed equally well and at far less cost by distribution fuse cutouts rather than reclosers.

To gain maximum effectiveness per recloser dollar expended, a recloser must perform its principal function, of clearing transient faults, over as many miles of line as is consistent with overlapping protection. The secondary function, of isolating persistent faults, can be delegated to the inexpensive fuse cutout. Coordinated series fuses, dividing the circuit into numerous short sections, have proven their value in limiting the extent of outages and speeding service restoration. With such an arrangement of recloser-fuse coordination, complete distribution overcurrent protection can be provided with a relatively small investment in protective equipment. The fullest realization of this objective is now possible with the hold-closed function of the automatic recloser—a function now in use on a number of systems.

**The Hold-closed Function . . .** Consider a hypothetical case in which all faults occurring on a system are of a

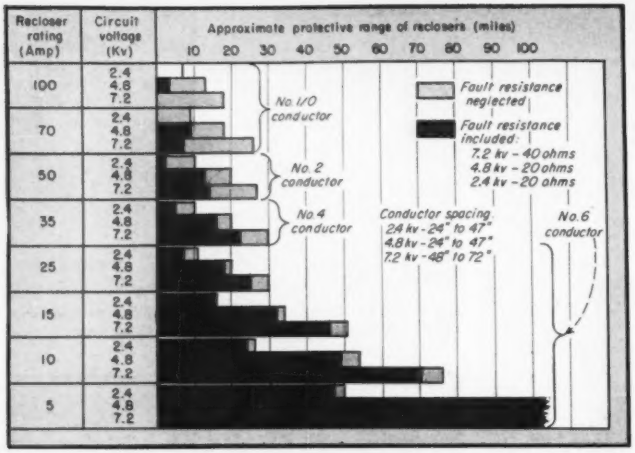



**FIG 3—PROTECTIVE RANGE of reclosers when installed at the point where maximum available fault current equals interrupting rating of the recloser**

persistent nature. It is impossible to keep faults from causing outages, but they can be isolated to limit the extent of outages. Primary overcurrent protection for such a distribution system could consist entirely of coordinated series fuses, as shown in Fig 1.

Fuses A, B, C and D on the main feeder are progressively smaller in rating proceeding away from the substation. Branch fuses A, B, C and D are of smaller rating than the nearest series fuse on the main feeder. Hence, faults anywhere on the circuit melt only the nearest series fuse on the source side of the fault. For example, a fault at (y) melts only fuse A and a fault at (z) melts only fuse C. Coordinated series fuses, therefore, isolate persistent faults to smaller areas and indicate the general location of each fault.

Actually 60% to 90% of all faults are transient. With the fuse scheme of Fig 1, transient as well as persistent faults would cause fuse blowing and require numerous trouble trips to restore service. It is essential, therefore, that some means be provided for distinguishing between transient and persistent faults. This is easily accomplished by supplementing the fuses with "hold-closed" reclosers as shown in Fig 2. The arrangement is identical to Fig 1 except that reclosers 1 and 2 have been added.

During short-circuit conditions, hold-closed reclosers 1 or 2 perform either one or two instantaneous openings for clearing transient faults before the branch or sectionalizing fuse can be even partially melted. If the fault is successfully eliminated, the recloser simply resets for normal operation. However, if the fault persists beyond the second operation, the recloser holds closed, forcing the proper fuse to isolate the fault. Then the recloser automatically resets for a complete new cycle of operations. With the hold-closed function, transient faults are cleared entirely by reclosers with only momentary circuit interruptions. Persistent faults are isolated entirely by fuses in the same manner described in Fig 1.

**Advantages of the Hold-closed Function . . .** There are three principal advantages of the hold-closed function:

### I. Low Cost Sectionalizing Between Reclosers

The hold-closed function readily permits coordination of reclosers with fuses located at branch junctions and transformer installations. Of particular significance, however, is the fact that only with hold-closed reclosers is coordination practical with fuses located between reclosers on the main feeder.

It is considered good operating practice to create sectionalizing points at 3- to 5-mile intervals on urban circuits and 10- to 15-mile intervals on rural circuits. Fig 3 shows that reclosers are capable of protecting line mileages much greater than the desired length of these protective sections. The hold-closed function allows the entire protective range of each recloser to be used because sectionalizing points are obtained not with reclosers but with coordinated series fuses. Thus inexpensive fuse cutouts can be substituted, with equally good results, at locations where reclosers might ordinarily be required.

### II. Wide Selection of "Time-delay" Characteristics

An important concept of the hold-closed function is that the time-current characteristic of the back-up fuses (in Fig 2, fuse A for recloser 1 and fuse C for recloser 2), perform the same function as the time-delay opening characteristic of the conventional recloser. The hold-closed recloser, of itself, has no fixed time-delay opening characteristic. When it holds closed during a fault in the section immediately beyond the recloser, the circuit is cleared in accordance with the characteristic of the back-up fuse. In effect, then, this fuse characteristic becomes the time-delay opening characteristic for the hold-closed recloser. This offers several advantages.

It will be recognized that the coordination between reclosers and fuses can be greatly improved and simplified if the time-delay opening characteristic of the recloser is similar in shape to the fuse characteristic. The hold-closed function accomplishes this objective. Moreover, this characteristic is readily adjustable simply by changing the rating of the back-up fuse. Either fast or slow fuses can be used to obtain the desired characteristic. Hence, the recloser can be easily fitted to various system requirements.

### III. Picking Up the Load After Extended Outages

Consider also the advantages of this application in handling inrush and motor starting currents attending outages. In the past it has sometimes been necessary to by-pass the recloser with a fuse to avoid locking the recloser open when picking up the load. This operation is now performed automatically. In the lower current portion of its operating range, the back-up fuse requires considerable time for

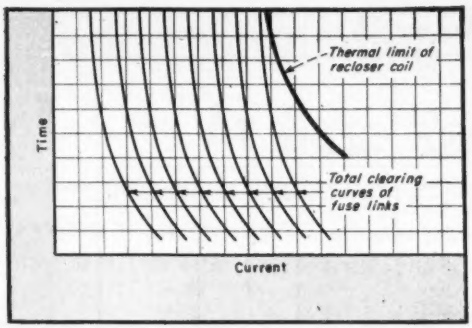



**FIG 4—FUSES WILL COORDINATE with hold-closed reclosers if their curves lie to the left of the curves of maximum safe operating temperature of the recloser coils**

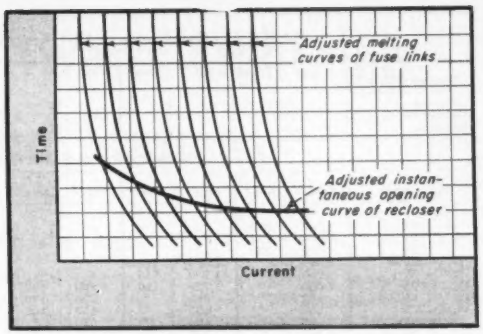



**FIG 5—MAXIMUM CURRENT for coordination of fuses and recloser lies at intersection of the adjusted fuse melting curve with the adjusted instantaneous curve of the recloser**

melting and is ideal for withstanding temporary inrush load. The recloser merely advances to hold-closed position, whereupon the back-up fuse affords the necessary time delay to pick up the load. When the temporary overload subsides, the recloser automatically resets and is again ready for instantaneous operation. It will be found that fuses, properly applied, afford a very satisfactory means of eliminating unnecessary lockouts under such conditions.

**Coordinating Hold-closed Reclosers With Fuses . . .** Complete tables on coordination of fuses with each rating of hold-closed reclosers have been published in convenient form. Although this information is available for most of the popular types of fuses, there may be some instances where the engineer will have to prepare his own tables. Therefore, it is desirable to understand the method used to obtain this information.

The maximum fuse link rating which can be used with each rating of recloser is determined by comparing the total-clearing time-current curves of the fuse links with the thermal characteristic curves of the recloser coils as illustrated in Fig 4. During hold-closed operation of the recloser, the fuse must clear the circuit before the recloser coil reaches its maximum safe operating temperature. All fuses having total-clearing curves to the left of the thermal curve of the recloser coil will meet this condition and can be coordinated with that rating of recloser.

The melting time-current curves of these fuses are then compared with the instantaneous time-current curves of the recloser to establish the maximum current at which the recloser will protect the fuse for two instantaneous operations. In making this comparison, the curve should be adjusted to include suitable allowances for the following operating variables:

**1.** Total heat input to fuse link during successive recloser operations.

**2.** Cooling effect on fuse during intervals that the recloser is open.

**3.** Reduction of 25% in melting time of fuse to factor preheating by load current and to avoid melting the fusible element without melting the strain wire.

It is advisable to prepare tables for recording the ratings of fuses which can be coordinated with each rating of recloser and the maximum current at which each fuse is protected by the recloser. Table I lists this information for all ratings of type FR reclosers when coordinated with 9FIC—series fast blowing fuse links. Similar data is available for other fuses.

**Application of Hold-closed Reclosers . . .** The initial steps in sectionalizing a distribution circuit are: (1) Selection of tentative sectionalizing points, and (2) calculation of maximum and minimum available fault currents. The maximum available fault current is based on maximum generation and a copper-to-copper fault. The minimum available fault current is based on minimum generation and usually includes some allowance for fault resistance.

Location of the first recloser can then be established, based on its ability to handle the load current and interrupt the maximum available fault current. The protective orbit of this recloser extends to that point on the circuit where the minimum available fault current equals the minimum pick-up current of the recloser. A smaller rating of recloser must be installed on the source side of this point to assure overlapping protection. This procedure is then continued until the entire feeder and all branches are within the protective orbit of a recloser. Hold-closed reclosers can be installed as far apart as is consistent with overlapping protection.

Having determined each recloser location, the next step is to establish the rating of the back-up fuse for the first recloser. This fuse must be protected by the recloser during transient faults up to the maximum available fault current at its point of installation and must melt before the recloser reaches its maximum safe operating temperature, as previously outlined. In addition it must also coordinate with substation relays or power fuses. Where the back-up fuse is located at the substation, it should provide short-circuit protection to the transformer. This can be determined by comparing the total-clearing curve of the fuse with the ASA time-load curve of the transformer. The rating of this back-up fuse will determine the number of sectionalizing points which can be obtained, based on the number of smaller fuse rating which can be used for coordination. Consequently, it should be as large as practicable, providing it will melt at the minimum available fault current at the end of its protective section.

The remaining feeder sectionalizing fuses and all branch fuses are se-

**TABLE I — Coordination of FR-1 Recloser With 9FIC Series Fast Blowing Fuse Links**

| Recloser Ratings | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Continuous | 100 | | 70 | | 50 | | 35 | | 25 | | 15 | | 10 | | 5 | |
| Minimum Pickup | 200 | | 140 | | 100 | | 70 | | 50 | | 30 | | 20 | | 10 | |
| Interrupting | 3,000 | | 2,100 | | 1,200 | | 875 | | 600 | | 375 | | 250 | | 125 | |
| | SHORT-CIRCUIT RMS AMPERES—RANGE OF COORDINATION | | | | | | | | | | | | | | | |
| Fuse Ratings | Max.[1] | Min.[2] | Max.[1] | Min.[2] | Max.[1] | Min.[2] | Max.[1] | Min.[2] | Max.[1] | Min.[2] | Max.[1] | Min.[2] | Max.[1] | Min.[2] | Max.[1] | Min.[2] |
| 100 | 3,000 | 390 | | | | | | | | | | | | | | |
| 101 | 2,300 | 250 | | | | | | | | | | | | | | |
| 125 | 1,800 | 370 | | | | | | | | | | | | | | |
| 100 | 1,300 | * | 1,360 | 180 | | | | | | | | | | | | |
| 52 | 1,200 | * | 1,260 | 130 | | | | | | | | | | | | |
| 95 | 1,060 | * | 1,120 | 150 | 1,200 | 180 | | | | | | | | | | |
| 85 | 880 | * | 880 | * | 900 | 140 | | | | | | | | | | |
| 75 | 560 | * | 600 | * | 650 | 105 | 680 | 120 | | | | | | | | |
| 51 | 560 | * | 600 | * | 650 | * | 660 | 120 | | | | | | | | |
| 50 | 390 | * | 430 | * | 470 | * | 480 | 82 | 500 | 93 | | | | | | |
| 45 | 270 | * | 320 | * | 360 | * | 370 | * | 390 | 72 | | | | | | |
| 40 | | | 220 | * | 250 | * | 275 | * | 290 | 54 | 310 | 60 | | | | |
| 30 | | | | | 180 | * | 210 | * | 220 | * | 240 | 48 | | | | |
| 25 | | | | | 130 | * | 150 | * | 170 | * | 185 | 34 | 195 | 36 | | |
| 20 | | | | | | | 100 | * | 120 | * | 135 | * | 145 | 27 | | |
| 15 | | | | | | | | | 86 | * | 100 | * | 110 | * | 120 | 22 |
| 10 | | | | | | | | | | | 70 | * | 80 | * | 88 | 15 |
| 8 | | | | | | | | | | | 53 | * | 62 | * | 70 | 11 |
| 5 | | | | | | | | | | | 35 | * | 46 | * | 54 | * |
| 3 | | | | | | | | | | | | | 25 | * | 34 | * |
| 2 | | | | | | | | | | | | | | | 17 | * |

[1] Maximum short-circuit current at which fuse link is protected during two instantaneous recloser operations.
[2] Minimum (300 second) melting current of fuse link.
* Short-circuit current less than minimum pick-up current of recloser.

lected based on their ability to coordinate with the associated recloser and with the nearest fuse on their source side. For example, in Fig 2, fuse B must coordinate with recloser 1 and with fuse A; fuse C must coordinate with recloser 2 and with fuse B, etc. Of course, the minimum available fault current at the extremity of each protective section must be sufficient to melt the fuse which protects that section. The fuse must also be capable of handling the load current at its point of installation.

Moreover, the sectionalizing and branch fuses must be large enough to coordinate with all transformer fuses within their protective sections. This is particularly important for, in the event of a transformer failure, the transformer fuse should melt without damage to the sectionalizing or branch fuse. If the latter melts, it becomes extremely difficult to locate the faulted transformer.

**Recording Coordination Data . . .** There are several advantages to recording the coordination data in the form shown in Table I. For example, assume that sectionalizing and branch fuses are to be selected for coordination with a 100-amp recloser. Considerable effort can be spared by marking the points on the circuit where the maximum available fault current corresponds to the maximum currents in Column 2, Table I. By thus zoning the circuit, the corresponding fuse ratings in Column 1 indicate the smallest fuse which can be used in each zone. With this method it is not necessary to give individual attention to fusing the numerous small branch circuits. The ratings for these fuses can be assigned by zones for both existing branches and those added later. Larger fuses may be used at more important locations where additional sectionalizing points are required on their load side.

In Column 3, Table I, all fuses rated 100 amp and smaller have a minimum melting current below the minimum pick-up current of the 100-amp recloser. These fuses will melt at the minimum value of current within their protective section and need not be checked on this point. If the reclosers have been located correctly, the minimum available fault current must be greater than the minimum pick-up current of the recloser and is, therefore, sufficient to melt each fuse.

# Induction Heating Cuts Costs 30%

**INDUCTION HARDENING** tip end of automotive valve with 20-kw heater

Automotive valve tip hardening costs have been reduced 30% with a 20-kw induction heater at the Thompson Products Co, Cleveland, Ohio. More consistent heating, hardness and hardness depth in treating valves has been obtained since the input and time under heat can be exactly controlled. Heater has processed more than 35,000 valves per day—operating on a 24 hr a day, 5-day week schedule.

Previous method used an oxyacetylene torch with an automatic chain conveyor belt. This was not suitable for large-volume production and production methods, and inspections were costly. Improvement in quality of valves was needed because of higher combustion temperatures in modern engines.

# Good Grounding Thwarts Lightning At Base Radio Stations

**Committee survey covering 213 exposure-years finds no repetitions of trouble after tying everything to a common ground**

Severity of lightning damage at radio stations used for communication by electric utilities is a function of a number of variable factors including:

**1.** The degree of exposure of the antenna, power service and remote control telephone circuit or any combination of these as a medium for entrance of lightning.

**2.** The nature of the lightning stroke, that is, whether a direct hit or streamers from a direct hit on an adjacent object.

**3.** The extent and effectiveness of the grounding system. Antennas are vulnerable to lightning in the majority of cases. The whip portion of the assembly is particularly susceptible to damage which in some cases does not prevent continued operation of the station.

Coaxial transmission lines are not subject to severe damage except minor failures of flexible connecting leads to the transmitter chassis, although reports of serious damage to both solid and gas-filled lines have been heard of but not confirmed.

Antenna transfer relays and remote control relays at the transmitter equipment are vulnerable points of damage.

Common ground network for all facilities at the station is essential as substantiated by reports of no repetition of trouble after this was accomplished.

**Survey 68 Stations . . .** Companies operating radio communication systems in the "Power Radio Service" have experienced lightning damage in varying degrees of severity at the base stations of their respective systems. The Communications Committee of the Pennsylvania Electric Association therefore obtained detailed information on the individual cases with the objective of minimizing damage from this cause and improving the continuity of radio service.

Data were obtained from two power companies operating in New York State, two in New Jersey and one in Maryland as well as seven from Pennsylvania.

Two-thirds of the reporting companies have experienced lightning damage (Table I) and 23.5% of the total stations in service were involved in the 24 damage cases reported. Seven of the cases (29.2) did not involve interruptions to radio service at the time of trouble, although subsequent interruptions were obviously required to repair the damage.

**Station-years . . .** One-third of the companies (Table II), operating 31% of the stations involving 44% of the total exposure-years did not experience any lightning damage. On the other hand 25% of the companies operating 26% of the stations involving 26% of the total exposure-years experienced four damage cases each.

Vertical half-wave coaxial antennas predominate. Both gas-filled and solid dielectric concentric transmission lines of various types have been employed and a variety of methods of installations are represented.

Two companies which have not experienced lightning damage report protective gap installations in service on the original antenna installations at five base stations. Another company reported the addition of a gap across the Lucite antenna insulator following repeated lightning damage at one station. A recent inspection of this gap showed no evidence of burning.

**Effect of Shielding . . .** Definite mention of damage to the antenna proper was reported in 54% of the cases. Assuming that the additional cases reporting damage only to transfer relays were due to lightning entering by way of the antenna, the figure due to antenna exposure is increased to 79% of the total cases.

Functioning of protector blocks and fuse protection on remote control telephone circuits was responsible for the loss of remote control of stations and in several cases serious damage occurred to the telephone circuits.

Grounding practices vary widely but in general buried counterpoise or ground grid networks are employed. In reconstructing the circumstances surrounding several cases in which the ac power supply facilities and telephone control circuits were involved, it appears that all equipment was not tied in to a common grounding system at the base station.

**TABLE I—Two-Thirds of Companies And One-Fourth of Stations Had Lightning Damage**

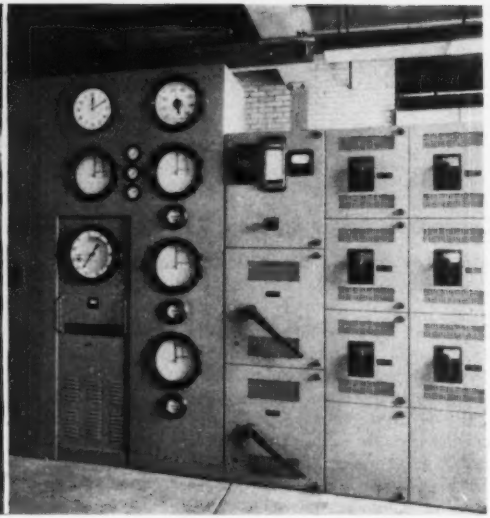
| | No. | Percent |
|---|---|---|
| Total companies reporting | 12(a) | 100.0 |
| Companies reporting no damage | 4 | 33.3 |
| Companies reporting damage | 8 | 66.7 |
| Total stations in service (including remote receivers) | 68(a | 100.0 |
| Total stations not affected by lightning | 52 | 76.5 |
| Total stations affected by lightning | 16 | 23.5 |
| Total number of damage cases | 24 | 100.0 |
| Damage cases involving no interruption to service at time of trouble | 7 | 29.2 |
| Stations having 4 damage cases | 1 | 6.25 |
| Stations having 3 damage cases | 1(b) | 6.20 |
| Stations having 2 damage cases | 3 | 18.75 |
| Stations having 1 damage case | 11(c) | 68.75 |
| Total stations having damage cases | 16 | 100.00 |

Note: (a) Excluding 1 company and 8 stations which have not been in service through lightning seasons.
(b) Two cases did not involve interruptions to radio service.
(c) Five cases did not involve interruptions to radio service.

**TABLE II—Station Exposure-Years**

| Lightning Damage Cases | Companies No. | Companies Percent | Stations No. | Stations Percent | Station-Years Exposure No. | Station-Years Exposure Percent |
|---|---|---|---|---|---|---|
| 0 | 4 | 33.3 | 21 | 31.0 | 94 | 44.1 |
| 2 | 3 | 25.0 | 24 | 35.3 | 49 | 23.1 |
| 3 | 2 | 16.7 | 5 | 7.3 | 13 | 6.1 |
| 4 | 3 | 25.0 | 18 | 26.4 | 57 | 26.7 |
| | 12 | 100.0 | 68 | 100.0 | 213 | 100.0 |

**OZONATOR BANKS at the Belmont (West Philadelphia) filtration plant have daily ozone capacity of 1,250 lb. This plant treats about 36 million gallons of water daily, using approximately 200 kwhr per million gallons of water ozonated**



**CONTROL PANEL (at right) for Belmont plant controls main 480-v circuits. Note space for two spare circuits at lower right. Instrument panel is at left. Each generator has its individual control with red and green indicator lights**

# You Can Build Load With Industrial Ozone

ELECTRICAL ENGINEERING IN INDUSTRY

**Ozone as an oxidant often can replace chemicals and effect a substantial saving. Electrical ozonators have a high load factor and provide an improvement in over-all power factor. Savings in operating costs pay for investment in short time**

**VICTOR HANN, Director, Ozone Processes Division**
**The Welsbach Corp, Philadelphia, Pa.**

The recent availability of large scale dependable, efficient ozone generating equipment has changed the role of ozone from that of a chemical curiosity to an industrial chemical of increasing importance. To the electrical industry it signals the advent of a new and extensive electrical load of favorable characteristics—because commercial ozone is produced entirely by electricity and electrical equipment.

Just recently, after more than ten years of research and development work, ozone generating equipment has been placed on the market which will produce ozone continuously, dependably, and efficiently in any quantity and at remarkably low cost.

Industrial ozonators are essentially electrically discharge machines. The ozone is formed between sets of electrodes separated by glass di-electrics in a narrow discharge space. The voltage impressed across the electrodes is 15,000 v; the air or oxygen passing through the discharge space is usually under a pressure of 8 to 10 psig. Ozonators of this design will generate twice as much ozone from oxygen as from air.

**Ozone Applications**. . . Prior to 1946, ozone had achieved only limited commercial importance, usually as a germicide or fungicide. With the advent of large scale ozone generating equipment, ozone is now available for a variety of applications where its unique and powerful oxidizing qualities make it better fitted and more economical to use in many oxidation problems.

Because ozone is unstable and reverts to ordinary oxygen within a short time after generation, it is necessary to install generating equipment at the point of application. This, of course, requires a fairly heavy initial capital expenditure; but elimination of materials handling problems and savings in operating cost have proven

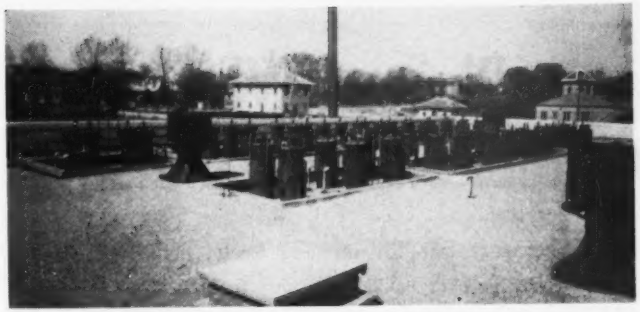
ample to pay for the investment in a very short time.

Cost-wise, ozone is competitive with many of the common oxidants. It has decided advantages in that use of ozone eliminates freight, demurrage, handling and storage costs necessary with other chemicals. A further advantage is that ozone adds no extraneous elements to oxidation reactions. With the exception of hydrogen peroxide (which adds only water), other common oxidants introduce substances other than oxygen to reactions in which they are involved.

At the present time, with procurement of oxidizing chemicals becoming more and more difficult and with freight and labor costs reaching ever higher levels, replacement of other oxidizing chemicals with ozone is becoming particularly attractive.

**Water Treatment . . .** Ozone has proven itself in water treatment at Philadelphia where it is used to oxidize manganese and taste and odor compounds, removing these undesirable elements from the water. Water from the notoriously bad Schuylkill River supply is made as fresh and palatable as spring water at the Belmont filtration plant where 36 million gallons of water are ozonated daily.

**Industrial Wastes. . .** Ozone will oxidize and destroy many objectional waste materials. Small scale and pilot plant tests have recently established the fact that ozone will oxidize and remove phenols from coke-oven wastes at reasonable cost. Phenol destruction at less than prohibitive cost has heretofore been considered virtually impossible. An ozone plant is now being constructed for oxidation of highly odorous material contained in a gas plant waste.

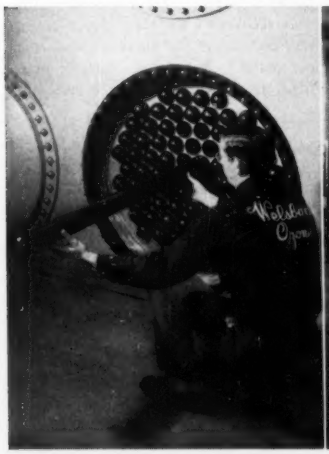


**TRANSFORMERS of standard distribution type, 480/15,000 v, 25 kva, supply ozone generators at 15,000 v. The 50 transformers are mounted on the roof Each generator has its own transformer. Each unit has 10-kva reactor which helps balance the leading power factor of the ozone generators**

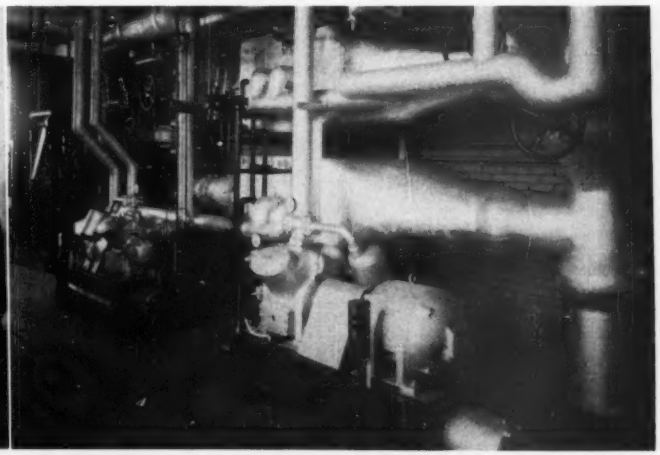
**Load Characteristics. . .** Most water purification, waste treatment and chemical oxidation applications are 24-hr, 7-day operations where the electrical load is a steady one, right around the clock.

In addition to high load factor, ozone plant load has another favorable characteristic. Ozonators are essentially capacitors and, as such, provide a load with leading power factor. The excess of lead is such that it will usually be sufficient to balance a substantial amount of the lag produced by motor load in other parts of the water plant, industrial plant or chemical works. The result is an improvement in over-all power factor.

For each pound of ozone generated from air, a total of 10 to 11 kwhr is required. In water purification applications something of the order of 200 kwhr are used per million gallons of water ozonated. The ozone plant at Belmont has an installed capacity of 750 kw and a nominal daily ozone capacity of 1,250 lb. Electrical capacities for industrial ozone plants, waste treatment or chemical works applications will vary in size from a few kilowatts up to several thousand kilowatts depending upon the magnitude of the problem.



**OZONE generating elements shown with the ozonator end plate removed**



**COMPRESSORS for refrigerating gas provide cooling effect for condensing water vapor from the air or oxygen. Complete removal of water vapor ups efficiency**

# Planned Wiring Catches on Fast—and Sticks

**Expect total of certified homes in 1950 to run over 1,000, compared to 42 in 1947, the last year before promotion was started**

**ROBERT L. COE, Residential Sales Manager**
**Union Electric Co of Missouri, St. Louis, Mo.**

St. Louis had already certified 750 homes up to November 14, 1950, and expects the total to run above 1,000 for the year, compared to 42 certified homes in 1947, the last full year before the present adequate wiring activity was started.

Theme of the promotion "It's Got To Be Big Enough To Do The Job," has become a popular synonym for adequate wiring in the area and ads about this dry subject are read by teenagers and dowagers. These ads which have featured giraffes, fat ladies, mice and other cartoon characters in the two-year old planned wiring campaign of Union Electric Co of Missouri have brought thousands of responses from readers.

Union Electric's campaign began in 1948. Believing that the usual wiring copy was too dull to attract readership, the company's advertising department set out to find a gimmick that would enliven their promotional campaigns.

It was decided that the selling of "adequacy" in wiring systems be minimized, and that the idea of convenience derived through sufficient outlets and good wiring be emphasized. Copy for the series of radio and newspaper ads sold adequate outlets for present and future uses of electricity and invited readers to send in for a booklet, "Plan Ahead by Wiring Ahead" which is designed for prospective home owners, renters, and those remodeling older homes.

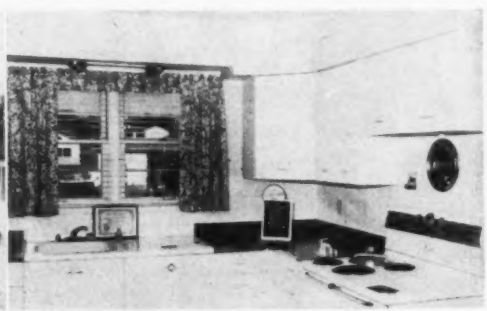
This booklet is used as the focal point for the whole promotional plan. It provides for the customer a room by room check list of appliances now in use in homes as well as those planned for future purchase. With it, the contractor or builder is helped in his ambition to provide sufficient outlets, properly located, with ample circuits and correct wire size for efficient and easy use of electrical equipment in the home.

**THINK BIG when considering wiring is the advice given to home builders**

**Train Salesmen. . .** Intensive preparation preceded the "Planned Wiring" campaign. Besides informing the electrical and building industry groups of the program, Union Electric personnel had to be trained to answer customer questions regarding good wiring.

A six-week's correspondence course was conducted for all residential sales personnel. Based on lesson plans from the Adequate Wiring Bureau plus

**THOUSANDS OF PEOPLE learned about adequate wiring as they inspected these homes in the $9,000 price range**



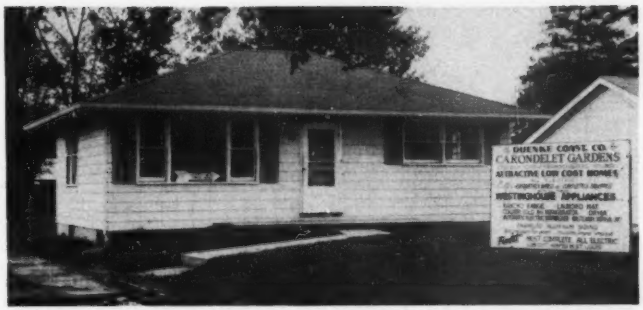
**"OF COURSE IT'S ELECTRIC" was the impression made by the kitchen. A free booklet gives facts to the homebuilder**

added materials, this course was enthusiastically received by employees and was of great value to them in their job of passing accurate information on to the public.

Special folders, including the "Plan Ahead" booklet and two proofs of the entire advertising series were mailed to electrical distributors, dealers, contractors, builders, realtors and financial institutions when the first ad broke on May 29, 1948. Jumbo post cards announced successive ads to the same groups and served as continuous follow-ups for the program. Twenty-four newspapers and nine radio stations are still plugging the planned wiring theme.

Response to the campaign was immediate and far beyond expectations, and has continued to grow during the two-year period. Requests for the booklet have come from all over America.

One paragraph of a Union Electric planned wiring ad pretty well explains the entire promotion. It reads, "Planned Wiring isn't something mysterious. It simply means providing enough electrical outlets and switches for all your present and future appliances." Brought down to simple terms of actual service to the customer, planned wiring catches on fast —and sticks. And Union Electric officials believe that the cartoons are worth continuing—because the number of outlets per dwelling unit and the number of homes certified as being adequately wired has increased tremendously since this campaign started.




**FINEST LOW-COST HOMES were advertised by builder of 200 all-electric bungalows. Since adequate wiring campaign began, outlets per home have gone way up**

## Electrical Living Centers Set Up in Company Divisions

Well-planned and carefully staged demonstrations of major appliances before selected audiences are rapidly becoming a daily load building activity of Southern California Edison Co. With five Electric Living Centers set up in as many divisions, and five more planned, the company in cooperation with dealers, distributors, and manufacturers is reaching a wide cross section of potential appliance customers every day.

The first demonstration center, featuring a complete electric kitchen, was set up primarily to provide weekly demonstrations to which dealers in the community could send prospects and purchasers for complete and authentic information on the use and advantages of electric appliances. A logical extension of these programs was to initiate dealer participation cooking schools, co-sponsored by all dealers carrying the same line or in the same area.

Dealers are required to invite prospects by letter or telephone, arrange suitable publicity for the school, have representatives in attendance to meet people and answer questions, and to report direct sales made as a result of the school. The schools are opened by an Edison representative who presents to the audience the home economist in charge. Dealers or manufacturers are invited to supply their own home economists, or Edison will supply all the personnel required for the school.

In one division the weekly public cooking school has been combined with a half-hour audience participation show on the local radio station. Cost of the program is defrayed by non-competing advertisers whose food products are displayed in the kitchen and used exclusively in the demonstrations. Since Edison furnishes the auditorium and equipment, dealers receive full benefit from the promotion, including spot announcements plugging the schools, for almost no cost.

**ELECTRICAL LIVING receives vigorous promotion in cooking and sales training schools and community group meetings held in divisional centers**

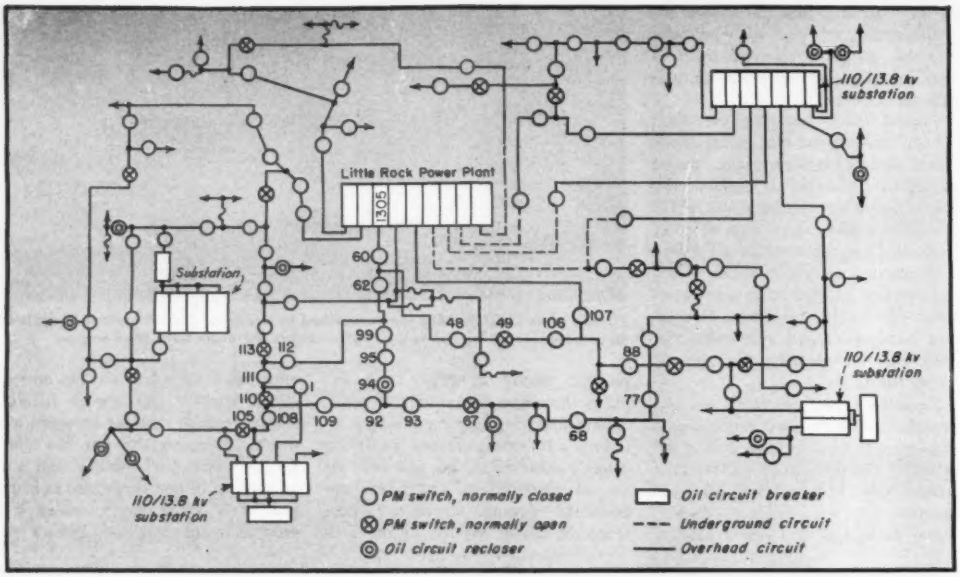



**FIG 1—13.8-KV DISTRIBUTION SYSTEM at Little Rock has numerous sectionalizing points, is primarily overhead, and could, under some circumstances, be operated in part as a loop or as radial feeders to reroute load in case of fault**

# Remote-Controlled Air-Break Switches Isolate Fault in Four Minutes

**Fifty-five remote-controlled air-break switches and 11 circuit breakers cut sectionalizing time to minutes. Motors operating the switches are controlled from dispatcher's office. System obviates need for purchasing outdoor substation sites**

R. A. WILLIAMS, Assistant Distribution Superintendent
Arkansas Power & Light Co, Little Rock, Ark.

V. B. WILFLEY, Engineering Supervisor
Westinghouse Electric Corp, St. Louis, Mo.

Locating and isolating trouble on the 13.8-kv Little Rock distribution system in a matter of minutes is possible with the new remote control sectionalizing switching system that has been installed by the Arkansas Power and Light Co. This contrasts with 45 min to an hour to gain these results without supervisory control.

System investment for the new supervisory control system was less than $100,000 and operating results have exceeded expectations. As an indication of this satisfactory performance, equipment has been purchased for a similar installation, on a smaller scale, for the Pine Bluff 13.8-kv system.

A one-line diagram of the 13.8-kv, 3-phase, 4-wire system is shown in Fig 1. This rather complex layout is the result of converting existing 2.3-kv lines to 13.8 kv, using the same right-of-way primarily because of the layout of the city and to care for the rapid expansion caused by unexpected new loads. The Little Rock system is primarily overhead and, as may be seen on the diagram, could under some circumstances be operated in part as a loop, or as radial feeders to care for unexpected change in load routing due to faults, or for other causes. Sectionalizing for rerouting loads or clearing faults before installation of supervisory control was accomplished by dispatching trouble shooters to the rather large number of pole-mounted gang-operated (PM) switches shown on the diagram. This required a considerable amount of

time, particularly under adverse traffic or weather conditions.

**Fault Isolation . . .** To illustrate how the isolation of faults is handled with the remote control system, a normal case of trouble on one of the typical 13.8-kv, 4/0 feeders is taken. Layout of the feeder is shown in Fig 2. Open circles indicate switches normally closed and crossed circles those which may be normally open.

Assume that a fault at point "C", Fig 2, relayed out the breaker at "A". The operator at the switchboard closes breaker "A" to determine whether the fault has cleared itself and to pick up load. If the breaker again relays out, indicating a permanent fault, the switchboard operator immediately notifies the dispatcher that circuit 1305 relayed out on two trials.

To isolate the fault:

**1.** Dispatcher immediately opens PM switch 112.

**2.** Dispatcher notifies the switchboard operator to close 1305.

**3.** If 1305 again relays out, PM switch 99 is opened.

**4.** Dispatcher notifies switchboard operator to close 1305.

**5.** If 1305 again relays out, PM switch 48 is opened.

**6.** If 1305 remains closed, fault is located between switch 48 and 49.

**7.** Dispatcher closes switches 112 and 99 restoring service to all customers except those between switches 48 and 49. This entire operation does not require more than four minutes.

Preceding the switching operation, the dispatcher radios all trouble shooters that circuit 1305 is open stand by. After isolation procedure is completed, trouble shooters are dispatched to locate the fault, determine its nature, and obtain the materials required to make repairs. This information is dispatched to line crews, resulting in considerable reduction in time necessary to restore service.

After the operator has located the fault and has isolated the faulted section, he can immediately, with the remote control system, restore service to customers on the feeder sections which are not involved. Emergency line crews can be dispatched promptly to the source of trouble. This means a decided reduction in outage time to all of the customers on the loop as well as to the customers on the faulted

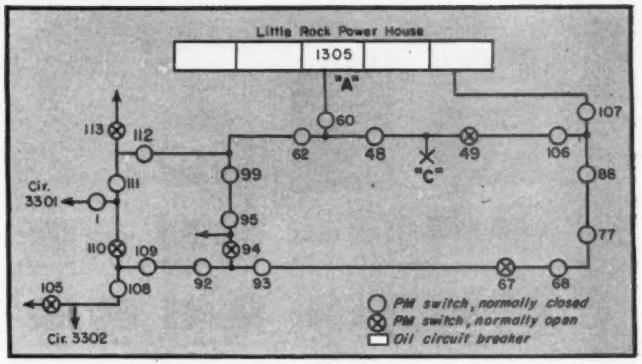



**FIG 2—FAULT LOCATION** on a 13.8-kv feeder is much quicker with remote control system. Text describes four-minute procedure for locating fault at point "C"

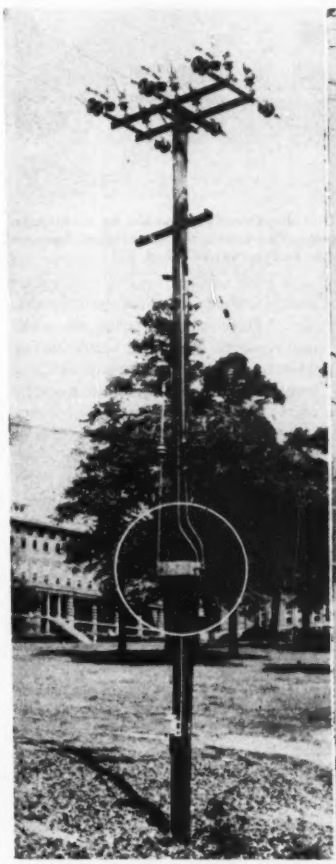


**FIG 3—MOTOR-OPERATED** mechanisms (circled above) are installed at 55 pole-mounted sectionalizing switches so they can be remotely operated by dispatcher

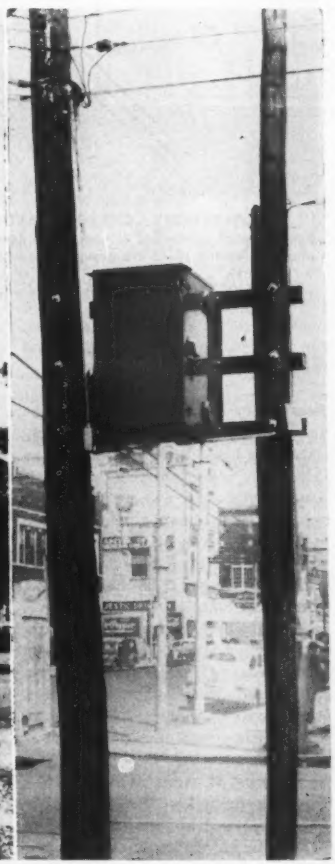


**FIG 4—FIELD CONTROL CABINET** controls five distant pole-mounted switches. Cabinets are connected by telephone lines to panel in the dispatcher's office

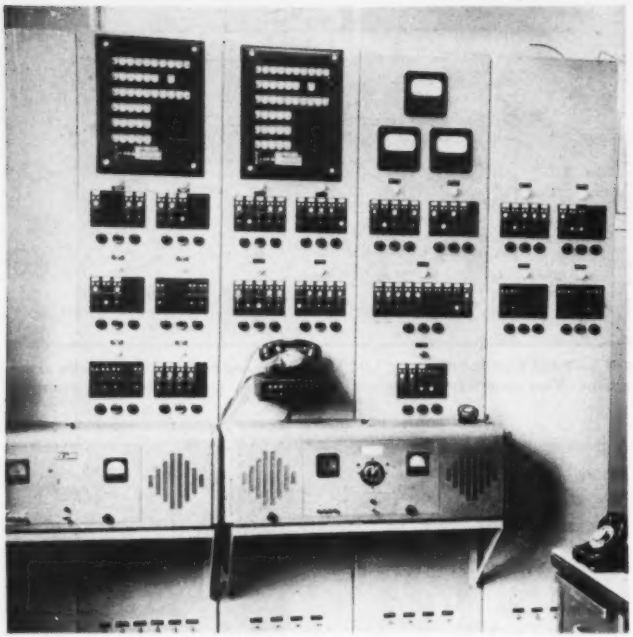


**FIG 5—SUPERVISORY CONTROL BOARD in dispatcher's office has an escutcheon panel for each controlled or supervised device. The five or ten escutcheons for each remote switching point are grouped together on the control board**

section. Everthing possible is done to minimize power outages to customers, and, as a result, permanent or sustained faults are now very infrequent.

**Supervisory vs Automatic . . .** The alternative method of improving service on the Little Rock system was the installation of an automatic sectionalizing scheme with a loop or primary network. With such a scheme, only the customers on the faulted section would be out of service and a sustained fault would be quickly and automatically isolated. However, referring to Fig 1, providing automatic sectionalizing at all locations where remote control sectionalizing is now available would be almost prohibitive from a cost standpoint. If automatic sectionalizing had been chosen it would have meant greatly reducing the number of sectionalizing points. Providing space for 15-kv, 250-Mva outdoor breakers and substation equipment at the proper locations was practically impossible.

With the Little Rock supervisory control, the operator is instantly informed of an outage and can proceed immediately to take corrective measures. This compares with the ordinary case of automatic sectionalizing where information regarding the trouble usually comes from customers, unless some type of remote breaker supervision is employed similar to that on the Little Rock system.

Other factors having to do with the selection of supervisory control were the need for remote control and supervision of a number of oil breakers, control and telemetering of rectifier stations, remote telemetering of certain feeder circuits, and a radio station control. These functions were easily accomplished over the telephone circuits provided for the control and supervision of the air break switches.

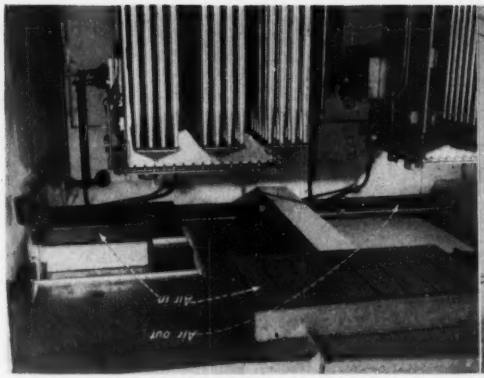
**Supervisory Control Equipment . . .** Plans were made in 1946 for a small initial installation of remote control and supervisory equipment. Improvement in system operation was so apparent that the program was expanded in 1948.

The present operating layout, therefore, includes remote control and supervision from the operator's office of 55 sectionalizing switches, 11 breakers, two rectifier stations, one radio station, four telephone communication circuits and three hot-line voltage indications. A number of spare supervisory points have been included for possible future use.

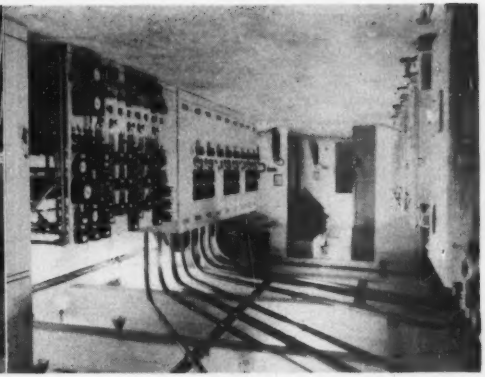
Two-wire leased telephone circuits from the dispatcher's office to each remote station provide complete control, supervision, telemetering, and telephone communication. In some cases where switches to be controlled were near a remote substation, the direct control wires were extended so that the extra switch, or switches, was treated as though it were a part of the remote sub. This plan reduced the number of leased circuits. It should be said, however, that the telephone company was most cooperative.

**Motor Mechanisms . . .** As a part of the modernizing program, it was necessary to apply motor-operated mechanisms to the PM switches. Necessary auxiliary switches were also added. A typical PM switch installation with motor mechanism is shown in Fig 3. These switches are capable of opening a load current of about 400 amp but are normally operated under no-load conditions. The remote control equipment and the disconnect switch mechanism are operated from 48 v dc obtained from rectifiers at these remote locations. Where necessary, automatic voltage transfer relays were installed to insure a positive operating power source for all conditions. This equipment, together with the supervisory relays and telephone line protective equipment, was installed in pole-mounted outdoor cabinets (Fig 4). Additional equipment was required at locations where it was necessary to provide for other functions. But the advantages far outweigh the small extra cost.

Control and supervision of all the remote stations are centralized in the system dispatcher's office in the Little Rock Power Plant. Fig 5 shows the dispatcher's supervisory control board. Each controlled or supervised device has its own escutcheon plate and the escutcheons connected with each remote switching point are grouped together. In addition to the escutcheons for each station, a common master control key, reset key, and check key are provided.



**STEEL FIRE DOOR** and concrete partition wall separate the oil-filled transformers from rest of the 36x84-ft substation interior. Now 6,000 kva, ultimately it will be 12,000 kva



**COOLING AIR** for transformers is brought in through a duct system by thermostatically-controlled blowers. Exhaust louvers are around the outside wall between roof and ground level

# Sunken Substation Serves in Beverly Hills

**H. L. RUDOLPH, Superintendent of Substations**
**Southern California Edison Co, Los Angeles, Cal.**

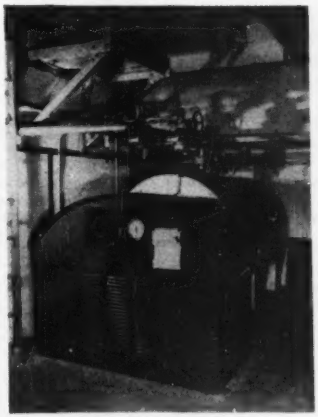
Maintenance costs for a sunken substation recently completed by Southern California Edison in a restricted residential area are far below those for an outdoor station. Over-all construction costs of the 6,000-kva, 16/4-kv station with its six individually-regulated feeders were only slightly in excess of the conventional outdoor type.

Excavation for the vault-type building which is 36x84 ft on a standard 50x112-ft lot was done by a clamshell shovel. The structure is 14½ ft in height, projecting 2 ft above ground level to make it conform in appearance with several underground water reservoirs also located in exclusive Beverly Hills.

**Building Design . . .** Reinforced concrete construction was used throughout the building. The roof is a continuous reinforced concrete slab supported by structural steel I beams spanning the width of the building and eliminating the use of columns. A waterproof membrane laid under the entire floor slab and footings extends far enough up the wall to prevent seepage of ground water.

The building has two entrances—a regular door at one end, and sliding hatches at the other end large enough for removal of the largest piece of equipment. These hatches also provide an emergency escape in case of fire or explosion.

The three 2,000-kva, single-phase, oil-filled transformers are separated from the rest of the building by a concrete partition wall and a steel door, which is kept shut under normal operating conditions. An automatic $CO_2$ system controlled by thermostats protects the station against damage from fire (Electrical World, Nov. 6, 1950). Warning notices are posted at the entrances informing those who enter the station that an alarm bell will ring shortly before the $CO_2$ is released and instructing them to leave immediately if the bell starts ringing.

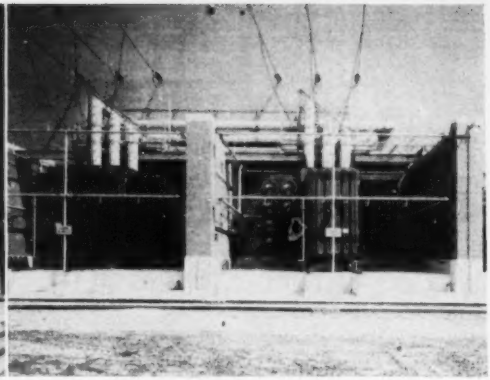


**FIRE PROTECTION** is provided by automatic $CO_2$ system. Warning bell sounds before discharge; exits at both ends allow escape for anyone in building

**Ventilation . . .** Blower fans which cool the transformers are thermostatically controlled to start when air temperature reaches 90 F, corresponding to about 65 C oil temperature. They exhaust through louvers in the two-foot space between the roof slab and the ground level along the perimeter of the building. Noise level adjacent to the station has been kept to an unobtrusive minimum by blower design and location of the louvers.

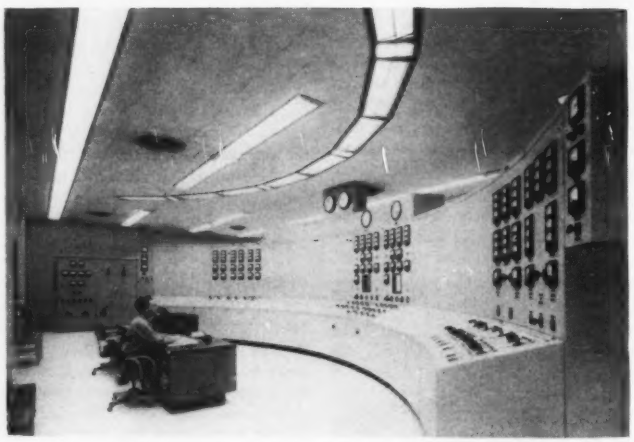
**Unattended Operation . . .** The station is designed for unattended operation, in line with Southern California Edison's practice for this type of station. Remote alarms transmitted to a control station indicate any of ten abnormal conditions including breaker operation, voltage failure, $CO_2$ system condition and operation, and transformer temperatures.

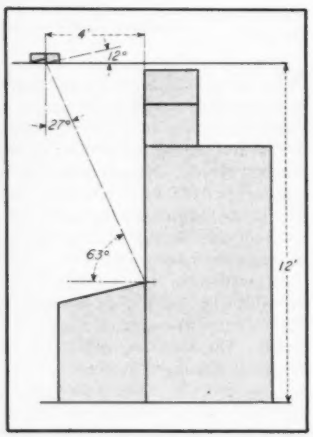
**1** COAL CONVEYOR is lighted by two rows of 150-w dust-tight RLM type units on 20-ft centers over catwalks on each side of conveyor. Rows are staggered so light on conveyor belt is essentially uniform—level of illumination is 5 ft-c



**2** TRANSFORMERS are lighted by 100-w vapor-tight brackets on barriers 10 ft above platform. Bus catwalk has 150-w vapor-tight RLM type units. Yard lighting is from 500-w refractor units at top of barriers on brackets

# Lighting Pepco's Potomac River Station





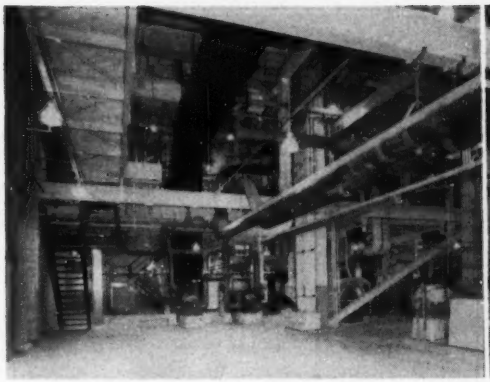

**5** CONTROL ROOM has rows of prismatic fluorescent lenses with two 40-w lamps. Four 200-w incandescent lamp symmetric lens units are used in emergency. Vertical board and bench board are lighted by eight twin (one) 40-w fluorescent asymmetric prismatic lens unit flushed into ceiling. Four twin 100-w incandescent units are for emergency battery lights

**Colors and Reflection Factors Play Important Part In Appearance and Comfort**

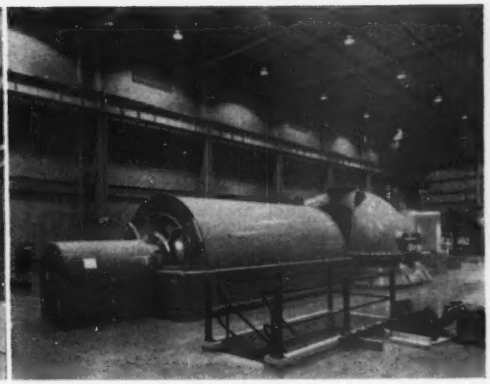
| Surface | Reflection Factor, Percent |
|---|---|
| Boards—Gray enamel | 45 |
| Ceiling—White Celotex | 80 |
| Walls—Tan tile | 50 |
| Floor—Gray rubber tile | 40 |
| Desks—Gray | 40 |
| Chairs—Aluminum | 60 |
| Kick Board—Black | 10 |

**Comparison of Actual and Design In-Service Illumination In Control Room**

| | In-Service Design Illumination, Foot-candles | Actual Measured In-Service Illumination After Six Months' Use, Foot-candles |
|---|---|---|
| Top of board | 30 | 32 |
| Bottom of board | 25 | 29 |
| Benchboard | 35 | 40 |
| Desks | 60 | 60 |
| Battery board | 25 | 30 |
| General room illumination | 60 | 60 |



**3** BOILER PLANT has 200-w prismatic glass industrial reflectors at convenient locations to give in-service intensity of 10 ft-c. Upward light component is desirable to illuminate overhead equipment and relieve upper-lower portion contrast



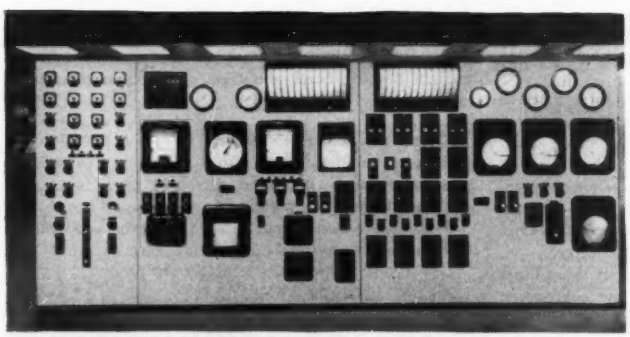
**4** TURBINE ROOM has high bay prismatic units with 1,000-w lamps mounted 44 ft above floor on 25 by 22-ft centers to give 20 ft-c in service. Ceiling is white with 70% reflection; walls tan brick, 40%; floor red, 25%

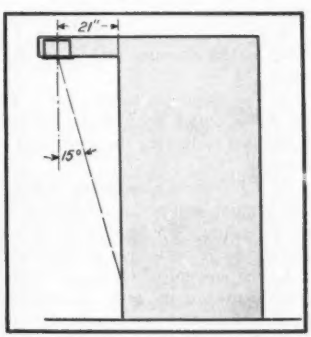
Modern lighting design sets good example of latest and best lighting practice, and provides good working conditions to safeguard health and safety of employees. Reflectivity of ceilings, floors, walls and equipment is an important factor. Efficient local control board lighting makes economical design and saves kilowatts on general room lighting

D. H. TUCK, Electrical Engineer
Holophane Co, Inc, New York, N. Y.

F. A. O'BRIEN, Engineer
Stone & Webster Engineering Corp, Boston, Mass.

**6** COAL UNLOADING PIT has dust-tight 200-w RLM type units to prevent dust and dirt depreciation. Spacing is 10 ft. Units are mounted 12 ft above platform. Two 500-w floodlights mounted on back wall project light into car

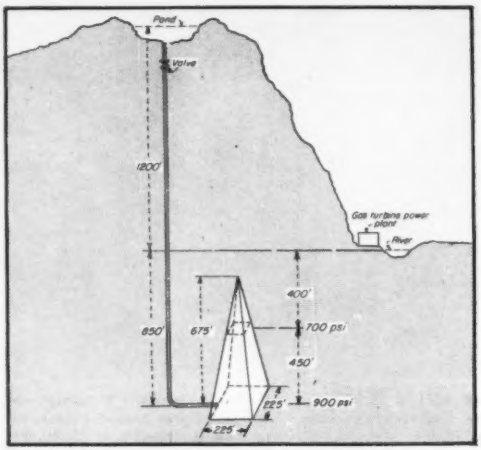





**7** BOILER BOARDS are lighted from an overhanging canopy having recessed prismatic lens boxes flush with top of board. Units are spaced on 2½ ft centers and each has two 100-w lamps. Units will accommodate up to 150-w lamps. Two of the 100-w lamps are on the emergency battery circuit. In-service illumination is 25 ft-c at top of board, 20 ft-c below

**Exploratory Thinking About Gas Turbine Economics**

There are a few engineers who think in unorthodox terms to make sure they miss no bets in hewing to conventional lines. One of them made this study in all seriousness. Electrical World by request publishes it without author identification. It typifies the trend of engineering thinking toward even more economic generation.—Editors.




**PYRAMIDAL CAVERN designed to store 17,000,000 cu ft of combustion air at 111 atmospheres for gas turbine plant**

# Off-Peak Air Storage For Peaking Gas Turbines

**Hypothetical cavern storing combustion air at 100 atmospheres could permit two-thirds saving per kw of gas turbine plant of conventional coupled-compressor design**

Gas turbines promise definite improvement in the thermal efficiency of fuel-burning generating stations. However, there are certain factors worthy of analysis because they offer increased opportunity to derive benefit from the higher efficiency:

**1.** The gas turbine at present is essentially a peak-load machine using oil or gas, both premium fuels.

**2.** Peak load stations should be located in or near the more or less extended area in which the peak load originates.

**3.** The simple gas turbine has to develop three times its net power output because two times the net power output is devoted to driving the associated combustion-air compressor.

**4.** It is therefore necessary to buy and maintain expensive rotating equipment amounting to five times the net power output; 3/5 of this operates at high temperature and should be considered as expendable to a degree.

**5.** The amount of oil or gas used is about three times that required if the task of compressing the combustion air were delegated to a coal-fired steam station.

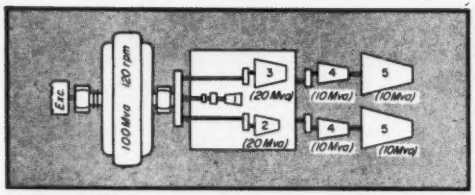
**6.** This would be a particularly advantageous shift if the combustion air were accumulated under pressure during off-peak periods.

**7.** Such an air storage reservoir of sufficient capacity for peak-period duration would permit full realization of the gas-turbine economy of fuel.

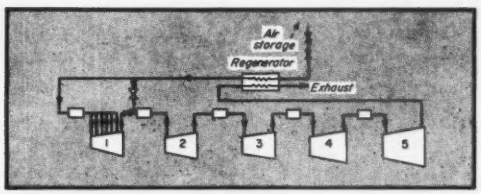
**8.** A metropolitan area with a 1,000,000-kw peak-load station will require some 23,300,000 kwhr of compressor input per week and this will require a reservoir of 17,000,000 cu ft at 111 atmospheres (1,632 psi).

**Air-reservoir Volume . . .** Volume requirements indicated in Item 8 above come about as follows from these basic assumptions:

| | |
|---|---|
| System peak load (assumed), kw | 5,000,000 |
| Peak-load station, rating, kw | 1,000,000 |
| Hours per day operation | 12 |
| Days per week operation | 5 |
| Peak load station output (per week), kwhr | 35,000,000 |
| Percentage of system output | 20 |
| Gas turbine compressor, weekly kwhr used (2/3) | 23,300,000 |
| Capacity of coal-burning steam plant to produce 23,300,000 kwhr in 168 hr, kw | 140,000 |
| Duration of pneumatic storage (Friday night to Monday morning), hr | 60 |




**SEVEN GAS TURBINE ELEMENTS (two low-pressure stages are split) giving five-stage expansion are coupled through speed-changer gears and pinion to 100-Mva slow-speed generator**




**FIVE 20-MW GAS TURBINES which have intermediate reheat to 1,500 F are coupled to a single 100-Mva generator in order to simplify the electrical end as much as possible**

Cu ft of free air in each so called "unit".....1,000
Pressure under which stored, atmospheres.....111
No. of stages of compression (with intercooling).....5
Energy consumption per unit of compressed air, kwhr .....4½
Air stored per hour (140,000/4.5), units.....31,000
Air stored in 60 hr of week-end, units.....1,860,000
Volume of 1,000-cu ft unit compressed to 111 atmospheres.....9
Required volume of storage, cu ft.....17,000,000

**Form of Storage Reservoir . . .** A cylindrical tank 147 ft in diameter and 1,000 ft long would be an impractical answer for 17,000,000 cu ft of storage at 1,630 psi. So would 1,000 tanks 50 ft long and 10.5 ft in diameter. In fact there should be a reserve of, perhaps, 35%. This would increase the number or sizes of the storage tanks in proportion.

This prompts an estimate of the cost of a 1,000,000-kw gas turbine plant provided with an underground cavern to store over the week-end the combustion air required for 60 hours of turbine operation during the week.

Two pyramidal caverns 675 ft high and 225 ft square at the base would not only give the necessary volume (with about one-third margin) but would apparently cost only $5,000,000 each and result in an over-all gas turbine station cost of $68 per kw. This is practically a third as much as a conventional gas turbine plant of 1,000,000-kw aggregate capacity would cost if each turbine drove its own compressor. Based on estimates given in the tables below, the over-all station cost would be approximately $68 per kw.

**Estimated Cost of Storage Plant**

| | |
|---|---|
| Excavation of pyramid 422,000 cu yd @ $7 | $3,000,000 |
| Lining surfaces @ $40 per sq yd | 1,500,000 |
| Sealing corners (3,600 lin ft @ $150) | 500,000 |
| Total cost of each cavern | $5,000,000 |

**Estimated Comparative Costs of Compressor and Storage Plants**

| Cost | Conventional | Storage Plant |
|---|---|---|
| Generators (1,000,000 kw @ $5) | $5,000,000 | $5,000,000 |
| Gas turbines @ $25 | 75,000,000 | 25,000,000 |
| Compressors (2,000,000 @ $60) | 120,000,000 | ..... |
| Compressor station | ..... | 28,000,000 |
| Storage (2 caverns) | ..... | 10,000,000 |
| Over-all station cost | $200,000,000 | $68,000,000 |

**Five Turbines per Generator . . .** In order to simplify the electrical end of the plant it would be desirable to use generators of at least 100,000-kva rating. But it may be some time before gas turbines will be feasible in larger than 20,000-kw ratings. Therefore the hypothetical plant will have five such turbines coupled in more or less planetary manner to the single generator through couplings, pinions and a bull gear. The combustion gases would be reheated to 1,500 F before passing in series from one to the next.

The first stage turbine would have a number of inlet positions to meet the dropping pressure at the air reservoir. When it has fallen to 900 psig as it emerges from the first stage heater the first turbine would be cut out of service and uncoupled. Couplings are installed so that any turbine unit can be replaced overnight with a spare.

**Operating Technique . . .** To avert linear decline in pressure of the stored combustion air it would be desirable to provide some means for holding the pressure up as consumption continues. This could be done by means of a 600-acre-feet pond atop the mountain under which the cavern is excavated. Water would be driven from the cavern to the pond by means of a vertical riser as the compressors fill the cavity over the week-end. Head of water would result in about 900 psig and further rise in pressure to 111 atmospheres (1,632 psig) would be achieved with closure of a valve in the riser. Heat of compression would be removed from the air and utilized in some way; air cooling would be necessary to derive full benefit of the storage in air poundage.

Another aid to pressure maintenance would be heating of the air by gas flame as soon as the gas turbines are started and begin to consume the air. This heating would be stopped as soon as the trapped air drops to the 900 psig value of the pond-riser pressure.

**Natural Gas Storage . . .** One could even go further with such a storage scheme now that natural gas is available throughout most of the densely populated area of the country. If the summer rate were sufficiently attractive it would be worth considering to store gas for 39 warm weeks to meet the entire gas fuel requirements of the area for the 13 cold winter weeks. If the gas company could meet the fuel needs of the gas turbines for three or four of the cold winter weeks the storage would in turn take care of the area fuel requirements for the remaining winter weeks in the event of diminished flow over the pipeline. It appears that there would have to be only a 1/3 summer reduction in price of natural gas to support the investment for both compression and storage.

**LOOSE SAND IS SOLIDIFIED** with a chemical solution to expedite tower footing excavation on Owens Gorge-Los Angeles line of Los Angeles Dept of Water and Power. Two 200-gal tanks of sodium carbonate solution and drums of sodium silicate are carried on one truck, as well as a 250-gal tank for mixing on the job

**INJECTION NEEDLE** for the solution is 12 ft of galvanized pipe jetted quickly into the sand and withdrawn slowly. Maximum hardening takes three days

# Soil Stabilization Speeds Tower Footing

**Here's how shifting sand can be solidified chemically so that a conventional auger can drill footing holes and concrete be poured without forms**

**E. C. GERSHOY, Engineer and CARL MUELLER, Associate Engineer**
**Los Angeles Department of Water and Power**
**Los Angeles, Calif.**

Tower footings in loose sand are being constructed by the Los Angeles Department of Water and Power with the aid of a mixture of sodium silicate and sodium bicarbonate that is injected into the sand for solidification. The mixture forms a silicic acid gel which holds the grains of sand together in a stable, homogeneous, semi-permanent mass that can be excavated by a conventional auger without sloughing or caving. Concrete can be poured directly into the bored hole without need for forms. This makes construction of the entire footing easy, economical and fast using ordinary concreting equipment.

Using this method a four-man crew can consolidate four footings per hour. The average rate is 16 footings (4 towers) per day, including time for travel to and from camp, preparation of solutions and moving equipment from one site to the next. Footings ranged from 20 to 38 in. in diameter, with a few as large as 48 in. Depending on diameter and depth of footing, porosity of the soil, and ease of penetration, each tower leg required injection of 160 to 500 gal of solution.

Drilling through the solidified soil is simple and rapid. Normal crews drill an average of four footings per hour, including travel and setup time. Best performance was drilling four footings for one tower in 35 minutes, and footings for seven towers in one morning. Engineers estimate that construction of formed footings in loose sand would take up to five days per tower with the same crew.

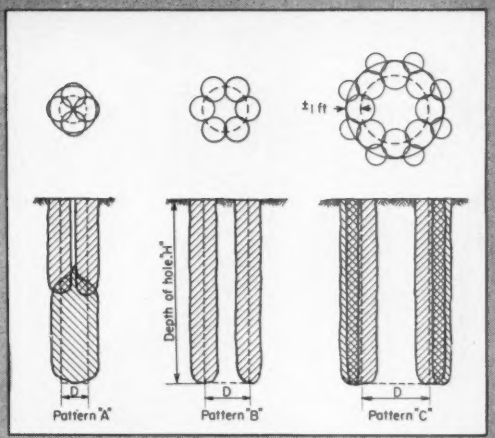
Department engineers modified the general method of solidification, which has been used before, to meet specifications calling for dimensionally stable, pole-type footing excavations on the Owens Gorge transmission line through desert sands to Los Angeles. Working with the Philadelphia Quartz Co of Cal., who supplied the chemicals, they altered concentrations, redesigned equipment to reduce costs and improve portability and flexibility, and established standardized operations for their use.

**Solution by Trial . . .** To determine the best proportions for the job, various combinations of sodium silicate, sodium bicarbonate and water were mixed with samples of sand taken from different points along the tower line. Their solidifying effect, storage life, and gel time were carefully checked. These experiments showed that a mixture of 12 parts by volume of "N" sodium silicate, 60 parts water, and 28 parts of a water solution containing 6.6 lb sodium bicarbonate per 100 lb was most economical.

This combination gels in 45-60 min, and is effective on all sand areas traversed by the line. Increased dilution with water tends to increase gelling time but reduces strength. Less water gives higher strengths and a shorter gel time.

QUANTITIES AND PATTERNS FOR SOLIDIFICATION INJECTIONS

| Footing diameter "D," inches | Solution required per foot of depth of hole: Injection points equally spaced around perimeter of hole — Number | Gal/ft | Total gal/ft of depth | Pattern |
|---|---|---|---|---|
| 20 | 4 | 4 | 16 | A or B |
| 26 | 5 | 5 | 25 | A or B |
| 32 | 6 | 5 | 30 | B |
| 38 | 7 | 5 | 35 | B |
| 48 | 8 | 6 | 48 | C |
| | 8 | 3 | 24 | |




# Excavation

Distances between towers in the field precluded consideration of any large scale system of stationary tanks, piping and storage facilities. Limited availability of water in desert and rural areas dictated that it be transported to each tower site in truck-mounted tanks along with pumps and other equipment. To reach many of the tower footings, it is necessary to travel over desert terrain in roadless areas. Tanks and other equipment is designed with high strength to withstand such operation. Splash guards on the tanks prevent spillage while transporting the prepared solution between tower sites.

**Equipment . . .** Strength, simplicity, and portability resulted from mounting all equipment on two 6x6 trucks and two trailers. One truck carries two 200-gal tanks for sodium bicarbonate solution, a 250-gal mixing tank, an air-operated duplex piston pump, and injection hoses and needles. It also carries drums of sodium silicate and sacks of sodium bicarbonate. A small 300-gal water tank is mounted on the trailer.

The second truck carries a 1,600-gal water tank, drums of silicate, a small gasoline - engine - powered centrifugal water pump, and pulls a trailer-mounted gasoline-powered air compressor. The trailer can be detached from the truck when the truck goes for extra water. The small 300-gal tank provides a reserve supply of water during the absence of the large tank.

Tank dimensions were adjusted to fit the truck bed, provide sufficient capacity for maximum batch sizes, and still allow adequate working space. Each compartment of the double soda tank was designed to take a 100-lb sack of sodium bicarbonate and 182 gal of water to make the required 6.6 lb per 100-lb solution. Open tops on the tanks provide for manual stirring necessary to mix the solution completely. Stirring with compressed air produced a chemical reaction, so was ruled out.

A hand-operated winch and crane raise the 700-lb, 55-gal drums of silicate so their contents drain directly into the volume-calibrated mixing tank. Sacks of sodium bicarbonate slightly larger than the common cement bag and weighing 100 lb are moved about manually as they are needed on the job.

**Preparing the Solution . . .** In preparing the solution, required quantities of sodium silicate and water are first stirred together in the mixing tank. The soda solution is then pumped in and the resulting solution immediately injected into the footing site. Reversing this procedure by adding silicate to the soda solution results in premature gelling in the mixing tank. Mixing tank, pump, hose and injection needle are flushed with water after each injection to prevent clogging.

Use of the double tank provides a continuous supply of the soda solution, with one batch being drawn while the second is being prepared.

The injection needles are 12-ft lengths of ½ and ¾ in. galvanized pipe with a hardened saw tooth tip welded on the end to prevent mushrooming. The 12-ft length provides adequate penetration for the maximum footing depth of 13 ft. Injection hoses are standard 1½-in. rubber pressure type.

In operation, the needle is injected into the ground with the solution under maximum pressure of approximately 100 psi. Considerable manual pressure and twisting is often required to penetrate consolidated strata and to replace rocks. The needle is jetted down as rapidly as possible and the penetrating solution pumped in as the needle is slowly withdrawn.

After injection the ground is left undisturbed for three days to realize maximum strength and stability. A hole can be drilled as soon as two hours after injection, but the longer curing period generally gives better results. Standard augers mounted on heavy trucks and tractors are used to bore through the solidified sand.

THIS IS TO INTRODUCE MY ASSISTANT
WHO WILL MAKE THE REGULAR PERIODIC INSPECTION OF YOUR ELECTRIC METER
YOUR ELECTRIC METER
ONE OF ABOUT HALF MILLION ON OUR SYSTEM, IS THE MOST ACCURATE COMMERCIAL MEASURING DEVICE IN THE WORLD.
DUQUESNE LIGHT COMPANY

**INTRODUCTORY LEAFLET** breaches gap in customer understanding of meterman's job, gains him access to premises

**IDENTIFICATION BADGE** allays customer fears where there is suspicion of strangers and fear of intruders

# Our Customers Know Their Meter Testers

**Here's a simple three-point program which helps to "humanize" the electric utility and ease the meterman's chores. The program is intended to let the customer know who you are, why you are there, and what he is gaining for his cooperation**

**EDWARD L. KELLER, Superintendent Meter Division**
**Duquesne Light Co, Pittsburgh, Pa.**

Customer understanding and good will are being generated more easily and in bigger quantities now that Duquesne Light Co has added a dash of straight-forward psychology to the meter tester's kit. Introduction, identification, and explanation of duties are the three ingredients of a program helping the meterman in his testing and customer relations roles. These ingredients take the form of a leaflet introducing the tester to the customer, a new identification badge, and explanatory lettering on the company's meter test trucks.

**Introductory Leaflet . . .** Each tester carries a stock of leaflets—imprinted with his name—that he hands to customers as an introduction and explanation of his duties. The folder has been especially helpful in districts where people are generally suspicious of strangers, or when newspaper headlines are focusing attention on intruders.

The leaflet shown here depicts Reddy Kilowatt introducing the tester "who will make the regular periodic inspection of your electric meter." The word "test" is not used. "Test" might infer that adjustment is necessary, whereas it is desired that customers realize that meters remain accurate and that adjustments are seldom needed. It is felt that the printed statement telling the customer his electric meter is the most accurate commercial measuring device in the world is, in itself, worth the cost of printing.

Second step was adoption of an identification badge or shield with black lettering and Reddy Kilowatt imprinted in red.

**Test Trucks Most Effective . . .** Possibly the most effective measure was introduction of test trucks for on-the-spot meter testing. While these brightly painted trucks are primarily for testing outdoor meters, they also inform residents of the "on foot" testers who are very often in the same vicinity.

A large-size Reddy Kilowatt is painted on both sides of the truck. On one side is a picture of a watthour meter and this message: "This specially equipped mobile laboratory helps keep your electric meter the most accurate commercial measuring device in the world." On the other side is an advertising message which may be changed from time to time.

**Customer Relations . . .** Experience with mobile meter testing shows that a new avenue of public good will has been opened up. It permits informing customers in the localities visited of meter practices and meter accuracy. The folder permits distribution of information on various phases of electric service. It is the meter tester's duty to see that the customer gets all that he pays for and that the company is correctly paid for its commodity. The net results is a distinct benefit in customer relations.

**METER TEST TRUCKS, plainly marked as to purpose, inform residents that company metermen are in the vicinity**

# first major fluorescent Street Lighting brilliant success in Detroit

"A beautiful, virtually glareless light, which contributes to easy and quick seeing, and adds to the comfort of motorists and pedestrians alike, thus resulting in increased safety." That's the way Louis J. Schrenk, Superintendent of the Public Lighting Commission, summed up Detroit's fluorescent street-lighting installation.

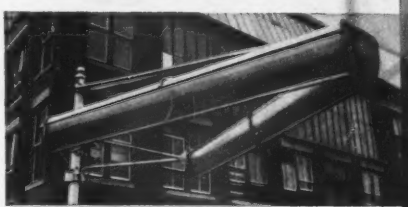
**LESS GLARE** These giant, 8-foot fixtures have about 5 times the light-giving surface area of conventional luminaires. This results in more light but lower brightness and less glare. This inherent advantage, plus an extremely broad pattern of light on the pavement, reduces glare to the lowest level ever attained in practical street lighting.

**PLEASANT APPEARING** Fluorescent—most nearly natural of all artificial light—is extremely eye-easing. Because of their pleasing color, low brightness, lack of glare, and uniform illumination, these new fluorescent luminaires "give the impression that there is more light on the pavement than for a standard installation of the same light level."

**STANDARD SPACINGS** Along Wyoming Avenue, one of Detroit's main traffic arteries, these new G-E Form 200 luminaires are spaced 140 feet between intersections and 100 feet at intersections. Mounting height is 25 feet. The four fluorescent tubes collectively produce 19,000 lumens—putting an average illumination of about 1.0 foot candle on the pavement.

**ANOTHER G.E. FIRST** The Detroit Lighting Commission and engineers of the General Electric's Illuminating Laboratory working together have advanced a laboratory hope to a brilliant accomplishment. A G-E Street-lighting Specialist is available to work with you. Ask your local G-E Apparatus Sales Engineer today. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Notice the extremely broad pattern of brightness between the camera and luminaire.



Distinctive, modern, attractive, that's G.E.'s new Form 200 luminaire. Two lamps are mounted in each half of the unit.

GENERAL ELECTRIC

452-123

# Secondary-Selective System helps paper company guard against production shut-downs . . . . . .

**G-E 5-kv Type MI-6 Metal-Clad Switchgear**—This unit handles the 4160-volt primary line circuits at the Fairfield Paper and Container Co. It consists of one incoming line breaker and four feeder breakers, as shown (in the one-line diagram at right above). Magne-blast air circuit breakers give adequate "IC" (Interrupting Capacity)—may be easily removed from cabinets for inspection or repair, with complete safety to personnel.

**G-E Cabinetrol* Units**—Five of these units are included in the Fairfield Paper and Container Co. installation. The unit above provides centralized control for the liner stock system, including motors, valves, agitators, etc. The ammeters record the load carried by the hydrapulper and hydrofiner. Note the neat appearance of the unit. Metal enclosed construction gives complete protection to operator.

*Reg. Trade-mark, General Electric Co.

## Continuous power assured at Fairfield Paper and Container Co.

Even in case of a complete failure of a transformer bank or its primary feeder cable, production at the Fairfield Paper and Container Company can still go on, at slightly reduced capacity.

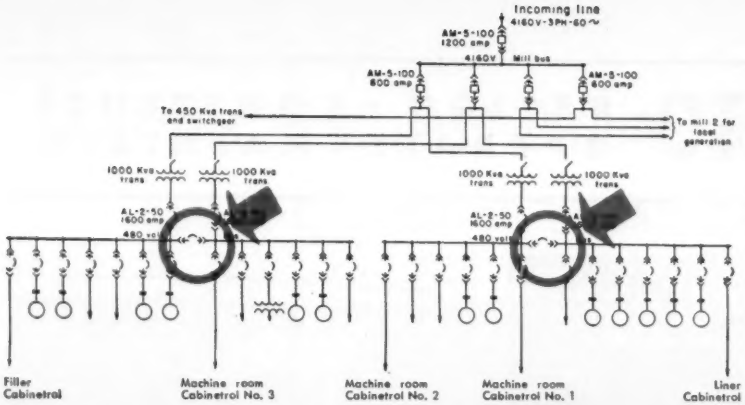
That's the result of using "secondary selective" power distribution, installed at only slightly higher cost than a simple radial system.

With this arrangement, power transformers are connected in pairs through a normally-open tie breaker. Should one transformer be de-energized, closing the breaker enables its partner to carry essential loads. Break-down of continuous-flow production operations is prevented.

Further protection against power failures is provided by General Electric metal-enclosed switchgear installed throughout the plant. Because all circuits are isolated in individual steel compartments and all equipment is perfectly co-ordinated for efficient operation, the danger of short-circuits and other faults is minimized.

**INVESTIGATE TODAY** the many advantages of using General Electric switchgear in *your* plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—or write for Bulletins GEA-3083 Metal-clad Switchgear; GEA-4966 Low-voltage Metal-enclosed Switchgear; GEA-3592 Load-center Unit Substations; GEA-3758 Load-center Power Distribution. ***Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

## ALL YOUR POWER GOES THROUGH YOUR SWITCHGEAR




**ONE LINE DIAGRAM** showing secondary-selective system at the Fairfield Paper and Container Company. Note the tie-breakers.

G-E low-voltage metal-enclosed equipments shown below contain tie breakers and transformer secondary breakers. They feed 480-v power to motors, lighting transformers and Cabinetrol units through Type AK-1 draw-out air circuit breakers of 25,000 ampere rating.

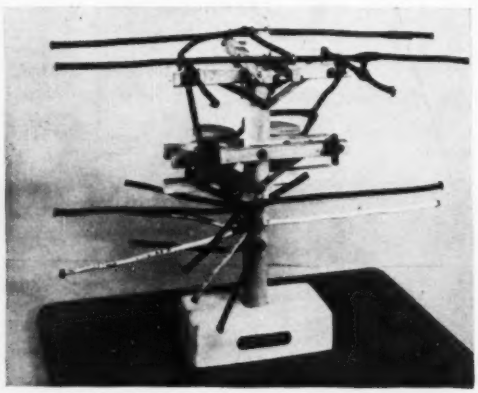
Transformer secondary breakers and tie breakers are Type AL-2, 1600 amperes, with 50,000 amperes interrupting rating.

# GENERAL ELECTRIC

854-34

# HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

**CONFERENCES with utility crews to analyze pole-top accidents can use scale models to illustrate shock hazards. Conferences of this nature are being led by the author (standing)**



**SCALE MODELS, such as this one, represent construction existing at the time of the accident. Although built to a scale of one inch to one foot, these models need not be replicas**

## Use Scale Models To Analyze Pole-Top Hazards

**ALFRED L. DOWDEN**
**Supervisor Public Utilities**
**Loss Prevention Dept**
**Liberty Mutual Insurance Co**
**Boston, Mass.**

Scale models of pole line construction have been developed to acquaint linemen with electric shock dangers. These are built on a scale of one inch to one foot. They are not intended to be replicas but are representative of the construction existing at the time of fatal and other serious accidents. This approach makes it possible to dispense with insulators, tie wires or extraneous details of construction not directly involved in the accident.

Models are made up on the basis of sketches, notes and pictures of the scene after the accident. The investigation makes available all known facts for a conference presentation of the case to small groups of about 12. Groups usually consist of linemen, distribution engineers and supervisors.

The discussion leader makes it clear at the start that the purpose of the conference is not to develop better construction methods but to analyze electric hazards. After describing each job, outlining the nature of the construction, identifying the wires on the model and locating the men on the pole, the leader narrates the sequence of events in each case. The group is then asked to analyze the job from an accident prevention standpoint.

These points placed on a blackboard are a guide to the discussion:

**1.** Was the job planned for safety? Were the hazards spotted?

**2.** Were the hazards controlled?

**3.** Was a safe plan of work followed?

**4.** Did the men doing the work profit by their experience to do the job safely?

Participation of the members of the group is stimulated by requesting specific comments on these general points as applied to each case. A color code can be used to identify the voltage, street lighting wires and neutrals. Miniature line hose and hoods show the location of the actual protection employed on the job.

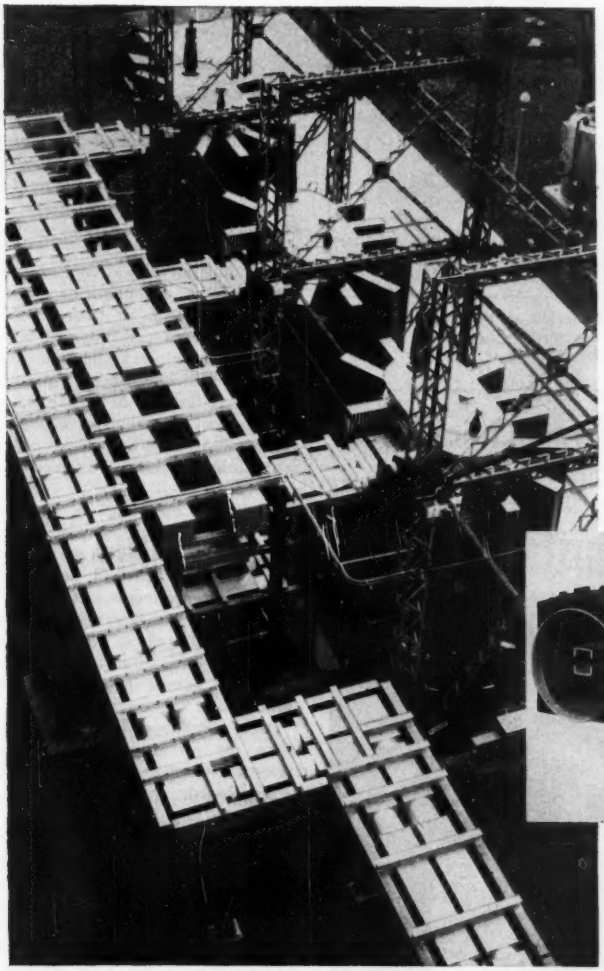
The leader then conducts a round table discussion. He writes each comment on the board and emphasizes how it applies to the models. During this part of the program all the models, which were presented individually, are placed on the table for reference. It takes about two hours to run off this program with six models, including a short recess.

In one fatal accident studied, the use of a scale model was very effective in illustrating how the accident could have been prevented. A lineman, kneeling on a buckarm with his belt around the arm, reached out almost 5 ft to connect a preformed tap on the street side of the bucks. Losing his balance, he fell across the phase conductors and made contact with one of them beyond the area protected by line hose. At the same time, his neck came into contact with the unprotected neutral.

The scale model showed that the accident would not have occurred if the neutral and phase wires had been protected further with rubber goods and if a lineman's platform had been clamped on the pole to afford the lineman a safer working position.

Now 14 out of 19

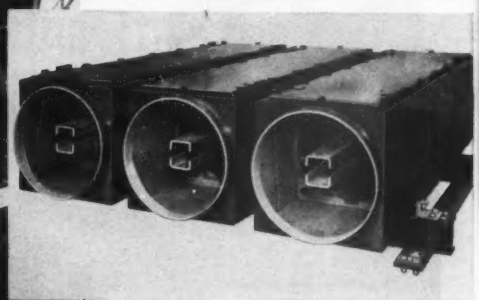
# ~~11 of the 16~~ largest turbine generators use G-E Isolated-phase Bus Runs



G-E isolated-phase bus runs provide maximum protection for vital interconnections between generators, transformers and main switchgear. They are dust-tight, weather-tight and factory-assembled to maintain adequate insulation values and mechanical strength. That's why they have been specified for the majority of the nation's largest turbine generators, either installed or planned.

Supplied in either individual phase sections or assembled as a complete three-phase package, G-E isolated-phase bus runs simplify installation problems and cut costs. Complete gasketing keeps the entire run weather-tight, reducing maintenance and the possibility of failures. You can open the hinged covers from either side for full flexibility, without removal of bolts. Ratings are 15 and 23 kv, 1200 to 7000 amperes.

Your G-E Sales Representative has

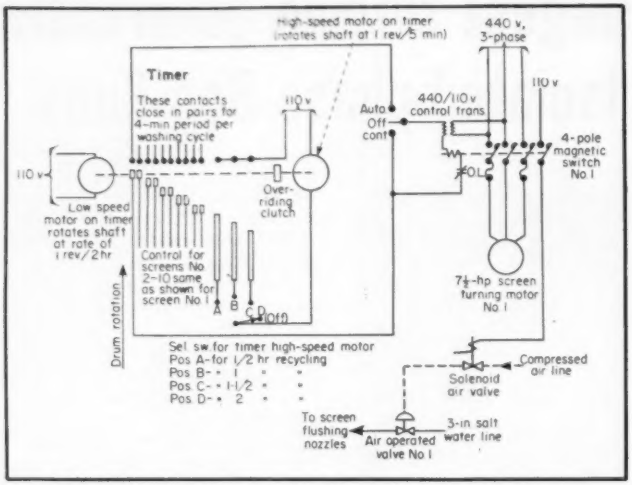


complete information about isolated-phase bus runs. Ask him for a copy of GEA-5460, a 28-page publication. It will aid you in planning your bus runs, or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

855-25

GENERAL ELECTRIC

# Automatic Control Saves Screen Washing Time


High-speed motor on timer (rotates shaft at 1 rev/5 min)
440 v, 3-phase
Timer
These contacts close in pairs for 4-min period per washing cycle
110 v
Auto Off cont
440/110 v control trans
110 v
4-pole magnetic switch No 1
110 v
Low speed motor on timer rotates shaft at rate of 1 rev/2 hr
Over-riding clutch
Control for screens No 2-10 same as shown for screen No 1
A
B
C
D
Off
7½-hp screen turning motor No 1
Drum rotation
Sel sw for timer high-speed motor
Pos A-for ½ hr recycling
Pos B- " 1 " "
Pos C- " 1½ " "
Pos D- " 2 " "
Compressed air line
Solenoid air valve
To screen flushing nozzles
Air operated valve No 1
3-in salt water line

**AUTOMATIC CONTROL for washing revolving screens at intakes of river water. Low-speed motor operates drum on timer during washing operation. High-speed motor picks up drive through over-riding clutch for recycling**

Automatic washing of rotating screens is performed by the aid of sequence timers at two generating stations of Consolidated Edison Co of N. Y., Inc. The screens are used at intakes where river water is drawn in for cooling purposes. They are washed automatically to save the time of employees on each watch for more important work.

### Hudson Avenue Installation

The first installation of this type was tried at the Hudson Ave. station. It replaced manual control for raising and flushing of ten circulating water screens. Schematic connections for the automatic washing installation at Hudson Ave. are shown in the accompanying illustration.

A turning motor was connected to each screen and an automatic sequence timer of the drum or rotary switch type was installed to operate each turning motor in sequence and at the desired interval. Solenoid operated valves were installed in the salt water flushing lines so that these would be opened automatically by the sequence timer during the time each screen was revolved.

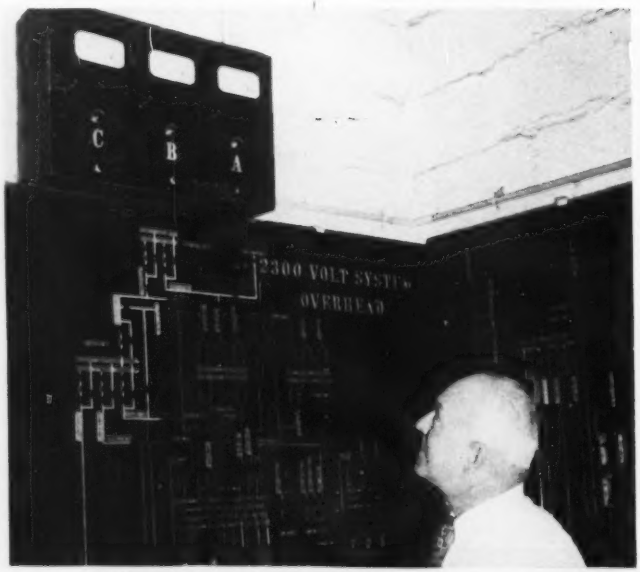
When the operating or washing cycle (regulated by low-speed timer motor) is complete and all ten screens have been revolved and flushed, a high-speed timer motor cuts in automatically. The rotary switch regulates the period of time to elapse before the screens are again automatically turned and flushed in the proper sequence.

Under conditions of maximum pollution the period between washing cycles is reduced; at other times it can be lengthened.

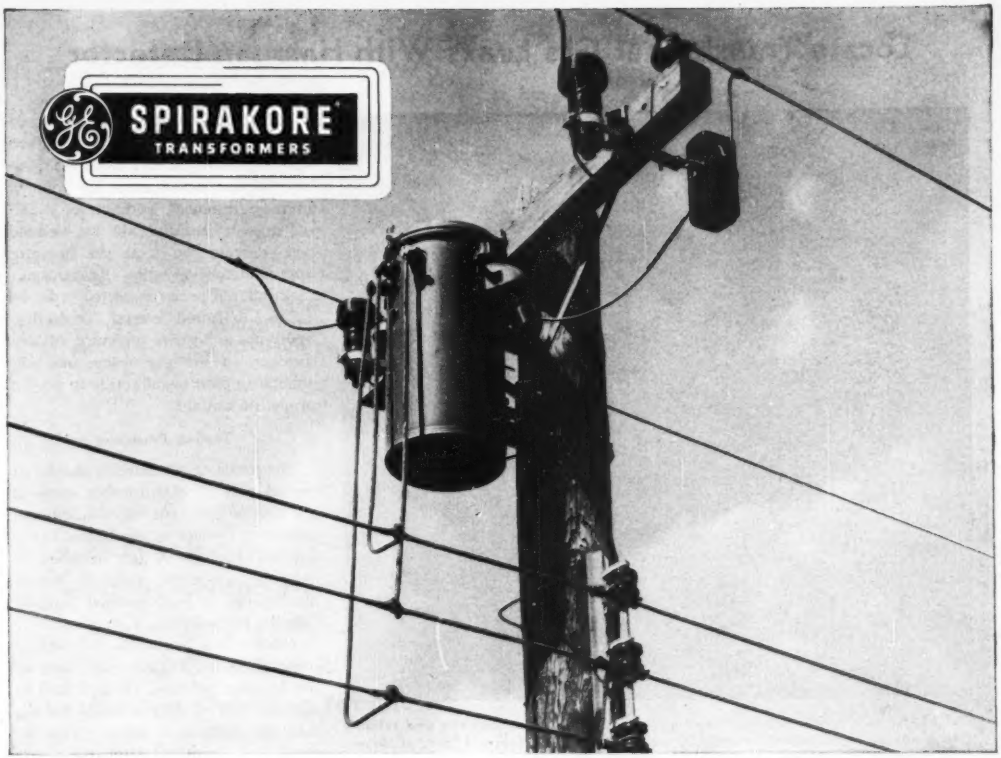
### East River Has Added Feature

Basically similar, an installation has been made at the East River station but it incorporates an added feature—a switch which regulates the screen rotation sequence on the basis of the differential in the water level on either side of the screens. When the differential becomes large because of clogged screens, the flushing mechanism is brought into play. Alarms are sounded and indicating lights are energized if the control system is interrupted.

# Phase Faults Indicated Quickly




**SERVICE DEPARTMENT trouble dispatcher for Richmond distribution system of Virginia Electric & Power Co knows as soon as it happens when a ground or other fault occurs on the 13.8-kv primary. He gets the information from a phase fault indicator mounted above his board. M. D. Minton, Supervisor-Emergency Service, checks voltage on the indicator. If a fault occurs, phase voltage drops and pilot lamp goes on**




# Finish on General Electric Transformers saves one, maybe two, repaintings

San Diego Gas and Electric has been running extensive tests on paint finishes. The Melaglyp paint on General Electric transformers, they say, is superior to any other paint tested. It will save one, maybe two, repaintings.

This is testimony from a company that has in one location almost every condition that is unfavorable to paint: Salt spray. Dry spells during which salt never washes off. Heavy dew. Intense California sunshine.

Melaglyp, a greatly improved paint made with melamine-modified Glyptal* alkyd-resin, has been standard on all G-E Spirakore transformers shipped since 1947. We are confident that you'll find this paint is cutting your maintenance cost.

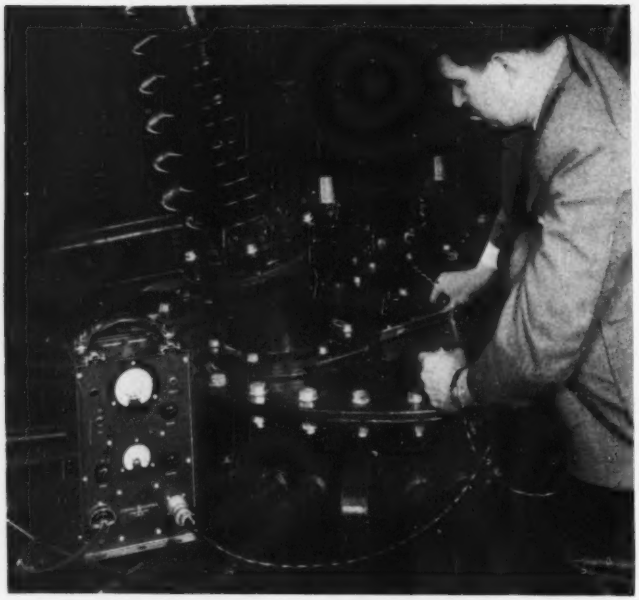
**Registered trademark of General Electric Company.*

*Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

402-104

GENERAL ELECTRIC

# Locate Transformer Gas Leaks With Halogen Detector



**GAS LEAKS** in power transformers can be located quickly, conveniently and reliably with a halogen-type leak detector. Control unit operates from a 115-v, ac supply


**R. S. PINDAR**

**Power Transformer Engineering Div**
**General Electric Co**
**Pittsfield, Mass.**


Gas leaks which develop in service in power transformers of the gas-seal, gas-oil-seal, or sealed type may be located reliably, quickly, and conveniently with a halogen-type leak detector. Use of this detector eliminates the shortcomings of the former soap-water method—time required to apply soapy solution to all possible leak areas; difficulty in reaching all areas and observing for formation of bubbles; and necessity of removing soapy solution after completion of tests. Use of the detector also eliminates the inconvenience in the oil-pressure method of supplying additional oil and oil-handling equipment, cleaning and dusting of questionable areas with powder, and extensive clean-up after testing.

The detector consists of a pistol-grip probe and a control unit. A sample of air is sucked through vapor-sensitive diode elements by a blower built into the probe unit. A halogen vapor or suspended halogen particles passing through the sensitive element will increase cathode-to-plate current flow. Deflections of an ammeter in this circuit indicate the presence of the halogen. Therefore, if a small amount of halogen gas is introduced into the transformer gas space as a tracer, any gas escaping through a leak literally will be "sniffed" by the detector.

Sulphur hexafluoride, which is available from commercial chemical companies, is recommended as a tracer for general use. Tests may be made on transformers filled with askarel coolants without the use of sulphur hexafluoride because askarel contains a halogen compound which acts as the tracer. To be effective, special cleaning is necessary to remove any of the askarel coolant from the outside of the tank before using the detector. Care must be taken not to saturate the sensitive element with concentrated halogen tracer fumes or a long waiting period will be required for the detector control unit to return to balance.

To locate gas leaks, the gas space of the transformer first should be filled with dry nitrogen and from 0.5% to 2% sulphur hexafluoride by volume. In most instances, addition of 1.5% of sulphur hexafluoride by volume will increase the total gas pressure approximately 0.3 lb. Transformer tank internal pressures in the order of 1.5 to 3 lb should be used. To do this, build up a positive pressure of dry nitrogen in the gas space and add enough sulphur hexafluoride to get the proper percentage.

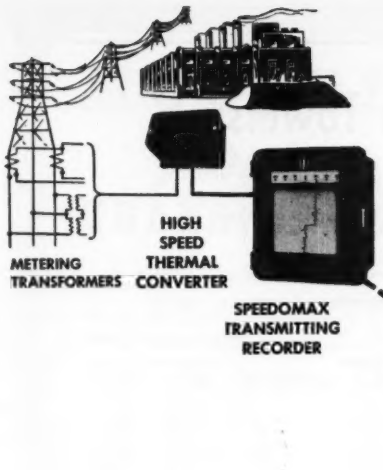
### Testing Procedure

The probe of the detector should be moved past all questionable areas at the rate of 2 in. per sec. Additional indicating devices as accessories to the detector include: A light operated by a relay; an audible signal by use of headphones or loud speaker plugged into the control unit.

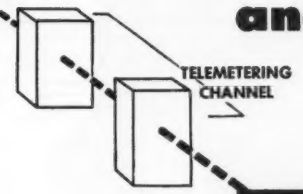
When a leak is noticed, it is well to recheck the area with the sensitivity of the detector reduced. Wait 5 min or more to allow more gas to leak out before the recheck is made. This recheck will ferret out false indications of leaks possibly caused by other halogen gas in the area.

It is suggested that users become familiar with the functioning of the instrument by experimenting with the detector using cigarette smoke or sulphur hexafluoride. Periodic checking with cigarette smoke during the test is also advisable. Carbon tetrachloride vapor may be used as a checking medium, but users are cautioned that the sensitive element may easily become saturated with carbon tetrachloride fumes and will require a long period for return to normal.

Before testing, it is advisable to observe for the presence of smoke or gases in the atmosphere which may contain halogens. This can be checked easily by holding the probe in a free area and noting the indication of the meter. If the transformer to be tested is indoors, it will be necessary to ventilate the enclosure to eliminate concentration of halogen gas. Testing on a windy day is not advisable because the tracer may be blown away before the probe can pick it up. After leaks are located and corrected, the transformer should be rechecked.




# Long-Distance Telemetering That's Fast and Accurate



- **High Accuracy**
- **Fast Response**
- **No Synchronization**
- **Wide, Detailed Record**
- **Works Over Any Distance**
- **Built-in Checking Features**

Power companies are getting any load facts they need from anywhere in the network—in just a few seconds—by using Speedomax Impulse Telemeters. This equipment works with any kind of telemetering channel—telephone circuit, carrier current or microwave link—and can operate over any distance within the capabilities of the channel.

At the sending end, a Speedomax recorder measures electrical load by means of a high speed thermal converter. It translates the load reading into regularly spaced impulses, whose duration varies with recorder reading. Impulses are transmitted by carrier or other channel to a Speedomax receiving recorder in the dispatcher's office. This Speedomax translates the impulses back into a continuous load measurement, duplicating the record of the transmitting recorder.

Response time is so short that the receiving recorder begins to show load swings within two seconds from the instant that load changes at the metering point. Accuracy is so high that charts from transmitter and receiver cannot be distinguished from each other. Every detail of load variations is readily visible on the 9⅞-inch wide Speedomax chart—a big help to the dispatcher in studying trends and making forecasts.

The Speedomax equipment needs practically no coordination with the telemetering channel. It can be used with any commercial carrier or microwave system. There are no synchronization problems, for the Speedomax receiver automatically keeps in step with the transmitter. Speedomax transmitter and receiver can operate from power sources of different frequencies. Built-in features help in checking the complete system. Failure of the telemetering impulse is indicated by a signal light on the Speedomax receiver. The telemetering channel can be checked and calibrated by means of integral adjustments, without the use of meters.

Speedomax Telemeters can be equipped with various control devices and incorporated directly into existing load-frequency control. For details about the equipment, write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad ND46-58-461(1)

# Painting Data for Transmission Towers

**Labor and paint costs are provided for steel towers, also formulas are given to determine painting costs for local conditions**

TABLE I—Approximate Costs of Painting Steel Transmission Towers

| Tower Weight, lb | Surface Area, sq ft | Paint Required, gal | Paint Cost (@ $4.00/gal) | Cost Computed on $2.25/hr Direct Labor | | | | Cost Computed on $2.75/hr Direct Labor | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Labor Cost (@ $2.25/hr) | Supervision and Inspection | Insurance, Overhead, Equip | Computed Total Cost | Labor Cost (@ $2.75/hr) | Supervision and Inspection | Insurance, Overhead, Equip | Computed Total Cost |
| 8,000 | 1,360 | 3.58 | $14.32 | $72.00 | $8.64 | $17.57 | $112.53 | $80.00 | $9.60 | $19.24 | $123.16 |
| 9,000 | 1,530 | 4.03 | 16.12 | 81.00 | 9.72 | 19.77 | 126.61 | 90.00 | 10.80 | 21.64 | 138.56 |
| 10,000 | 1,700 | 4.47 | 17.88 | 90.00 | 10.80 | 21.96 | 140.64 | 100.00 | 12.00 | 24.04 | 153.92 |
| 11,000 | 1,870 | 4.92 | 19.68 | 99.00 | 11.88 | 24.15 | 154.21 | 110.00 | 13.20 | 26.45 | 169.33 |
| 12,000 | 2,040 | 5.37 | 21.48 | 108.00 | 12.96 | 26.34 | 168.78 | 120.00 | 14.40 | 28.85 | 184.73 |
| 13,000 | 2,210 | 5.82 | 23.28 | 117.00 | 14.04 | 28.55 | 182.87 | 130.00 | 15.60 | 31.27 | 200.15 |
| 14,000 | 2,380 | 6.26 | 25.54 | 126.00 | 15.12 | 30.74 | 196.90 | 140.00 | 16.80 | 33.67 | 215.51 |
| 15,000 | 2,550 | 6.71 | 26.84 | 135.00 | 16.20 | 32.94 | 210.98 | 150.00 | 18.00 | 36.07 | 230.91 |
| 16,000 | 2,720 | 7.16 | 28.64 | 144.00 | 17.28 | 35.15 | 225.07 | 160.00 | 19.20 | 38.47 | 246.31 |
| 17,000 | 2,890 | 7.61 | 30.44 | 153.00 | 18.36 | 37.34 | 239.14 | 170.00 | 20.40 | 40.88 | 261.72 |
| 18,000 | 3,060 | 8.05 | 32.20 | 162.00 | 19.44 | 39.54 | 253.18 | 180.00 | 21.60 | 43.29 | 277.09 |
| 19,000 | 3,230 | 8.50 | 34.00 | 171.00 | 20.52 | 41.73 | 267.25 | 190.00 | 22.80 | 45.69 | 292.49 |
| 20,000 | 3,400 | 8.95 | 35.80 | 180.00 | 21.60 | 43.92 | 281.32 | 200.00 | 24.00 | 48.09 | 307.89 |
| 22,000 | 3,740 | 9.84 | 39.36 | 198.00 | 23.76 | 48.31 | 309.43 | 220.00 | 26.40 | 52.90 | 338.66 |
| 24,000 | 4,080 | 10.74 | 42.96 | 216.00 | 25.92 | 52.70 | 337.58 | 240.00 | 28.80 | 57.72 | 369.48 |
| 26,000 | 4,420 | 11.63 | 46.52 | 234.00 | 28.08 | 57.09 | 365.71 | 260.00 | 31.20 | 62.52 | 400.24 |
| 28,000 | 4,760 | 12.53 | 50.12 | 252.00 | 30.24 | 61.48 | 393.84 | 280.00 | 33.60 | 67.34 | 431.06 |
| 30,000 | 5,100 | 13.42 | 53.68 | 270.00 | 32.40 | 65.87 | 421.95 | 300.00 | 36.00 | 72.14 | 461.82 |
| 32,000 | 5,440 | 14.32 | 57.28 | 288.00 | 34.56 | 70.27 | 450.11 | 320.00 | 38.40 | 76.95 | 492.63 |
| 34,000 | 5,780 | 15.21 | 60.84 | 306.00 | 36.72 | 74.66 | 478.22 | 340.00 | 40.80 | 81.76 | 523.40 |
| 36,000 | 6,120 | 16.11 | 64.44 | 324.00 | 38.88 | 79.05 | 506.37 | 360.00 | 43.20 | 86.57 | 554.21 |
| 38,000 | 6,460 | 17.00 | 68.00 | 342.00 | 41.04 | 83.44 | 534.48 | 380.00 | 45.00 | 91.38 | 584.98 |
| 40,000 | 6,800 | 17.89 | 71.56 | 360.00 | 43.20 | 87.84 | 562.60 | 400.00 | 48.00 | 96.19 | 615.75 |

### Painting Cost Formulas Adaptable for Local Conditions

Legend: $C$ = cost, in dollars
$P$ = paint cost per gallon, in dollars
$W$ = wage rate of painter, in dollars per hour
$Y$ = paint life, in years

1. Paint cost per 1,000 sq ft of steel tower surface (based on paint coverage of 380 sq ft per gal) equals:

$$C_p = P \times 1{,}000/380 = 2.632P$$

2. Direct labor cost per 1,000 sq ft (based on area cleaned and painted per painter per 8-hr day is 340 sq ft) equals:

$$C_l = 8W \times 1{,}000/340 = 23.529W$$

3. Supervision cost per 1,000 sq ft (based on a supervision cost of 12% of direct labor cost) equals:

$$C_s = 0.12\ (23.529W) = 2.824W$$

4. Insurance cost per 1,000 sq ft (based on an insurance cost of 1% of direct labor cost) equals:

$$C_i = 0.01\ (23.529W + 2.824W) = 0.263W$$

5. Total cost per 1,000 sq ft (based on overhead costs taken as 15% of all costs including overhead, or 17.65% of all costs before overhead) equals:

$$C_a = (1 + 0.1765) \times (2.632P + 26.616W) = 3.096P + 31.314W$$

Data and formulas adapted from a forthcoming manual entitled "Transmission Tower Painting," courtesy Joseph Dixon Crucible Co.

TABLE II—Direct Labor Cost per 1,000 Sq ft of Tower Surface, for Cleaning And Painting (One Coat) at Various Hourly Wages

| Hourly Wage Rate | Labor Cost per 1,000 sq ft |
|---|---|
| $1.75 | $41.18 |
| 2.00 | 47.06 |
| 2.25 | 52.94 |
| 2.50 | 58.82 |
| 2.75 | 64.71 |
| 3.00 | 70.59 |

TABLE III—Paint Cost per 1,000 sq ft of Tower Surface, for Paint at Various Purchase Prices

(Based on "average" coverage of 380 sq ft per gal)

| Purchase Price per gal | Paint Cost per 1,000 sq ft |
|---|---|
| $3.50 | $9.21 |
| 4.00 | 10.53 |
| 4.50 | 11.82 |
| 5.00 | 13.16 |
| 5.50 | 14.47 |
| 6.00 | 15.79 |
| 6.50 | 17.10 |
| 7.00 | 18.42 |

6. Total cost per 1,000 lb of steel tower weight (for conversion, formula 5 is multiplied by constant 0.17) equals:

$$C_w = 0.526P + 5.323W = 0.53\ (P + 10W)$$

TABLE IV—Approximate Total Painting Cost Per Year for Towers of Various Weights

(Assuming an average paint life of five years)

| Tower Weight, lb | Total Painting Cost per Year @ $2.25 per hr, Direct labor | Total Painting Cost per Year @ $2.75 per hr, Direct labor |
|---|---|---|
| 8,000 | $22.51 | $24.63 |
| 9,000 | 25.32 | 27.71 |
| 10,000 | 28.13 | 30.78 |
| 11,000 | 30.84 | 33.87 |
| 12,000 | 33.76 | 36.95 |
| 13,000 | 36.57 | 40.03 |
| 14,000 | 39.38 | 43.10 |
| 15,000 | 42.20 | 46.18 |
| 16,000 | 45.01 | 49.26 |
| 17,000 | 47.83 | 52.34 |
| 18,000 | 50.64 | 55.42 |
| 19,000 | 53.45 | 58.50 |
| 20,000 | 56.26 | 61.58 |
| 22,000 | 61.89 | 67.73 |
| 24,000 | 67.52 | 73.90 |
| 26,000 | 73.14 | 80.05 |
| 28,000 | 78.77 | 86.21 |
| 30,000 | 84.39 | 92.36 |
| 32,000 | 90.02 | 98.53 |
| 34,000 | 95.64 | 104.68 |
| 36,000 | 101.27 | 110.34 |
| 38,000 | 107.90 | 117.00 |
| 40,000 | 112.52 | 123.15 |

7. Annual total cost per 1,000 lb of tower weight (for conversion, formula 6 is divided by the life expectancy of the paint) then equals:

$$C_y = [0.53 \times (P + 10W)]/Y$$

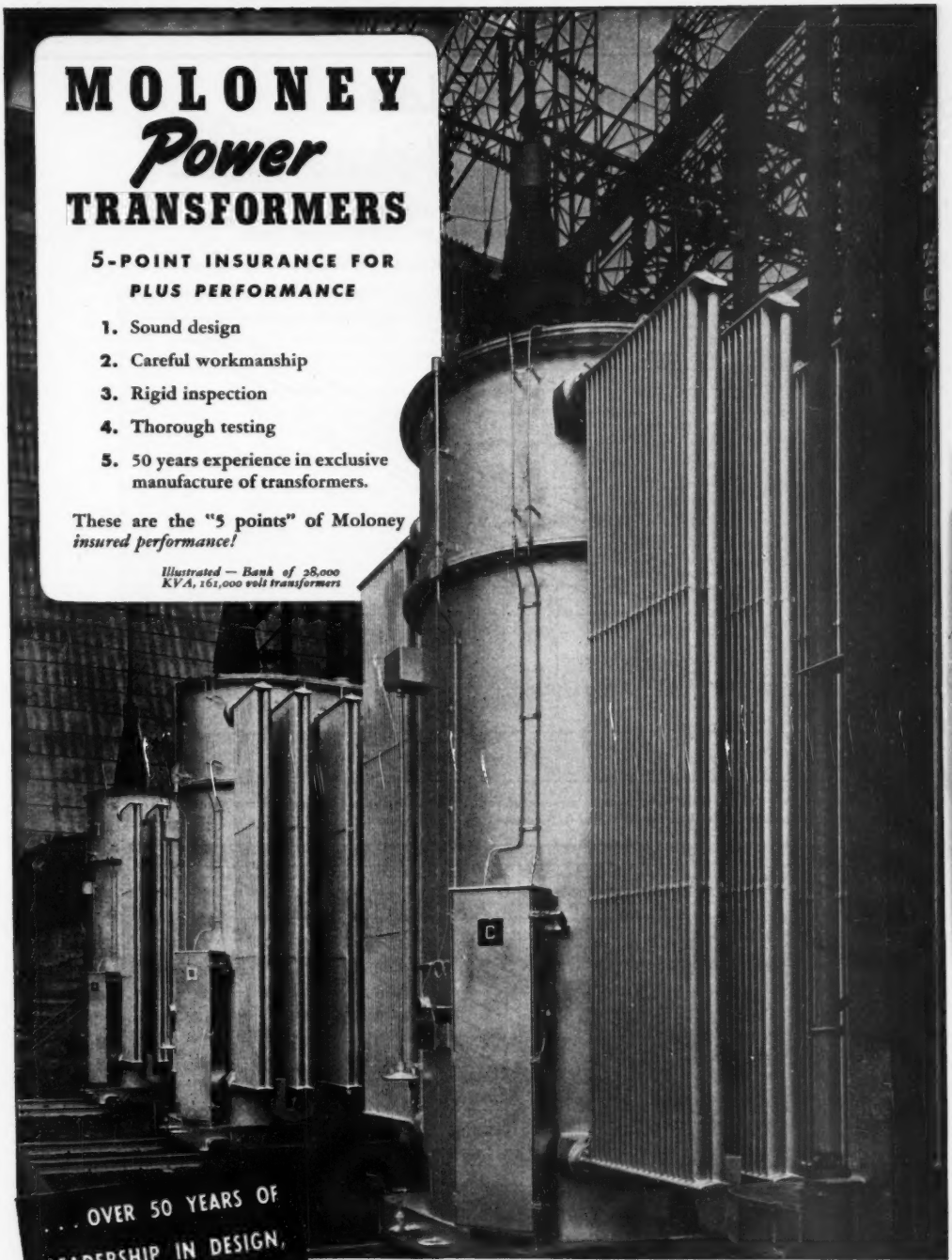
# MOLONEY *Power* TRANSFORMERS

**5-POINT INSURANCE FOR PLUS PERFORMANCE**

1. Sound design
2. Careful workmanship
3. Rigid inspection
4. Thorough testing
5. 50 years experience in exclusive manufacture of transformers.

These are the "5 points" of Moloney *insured performance!*

*Illustrated — Bank of 28,000 KVA, 161,000 volt transformers*



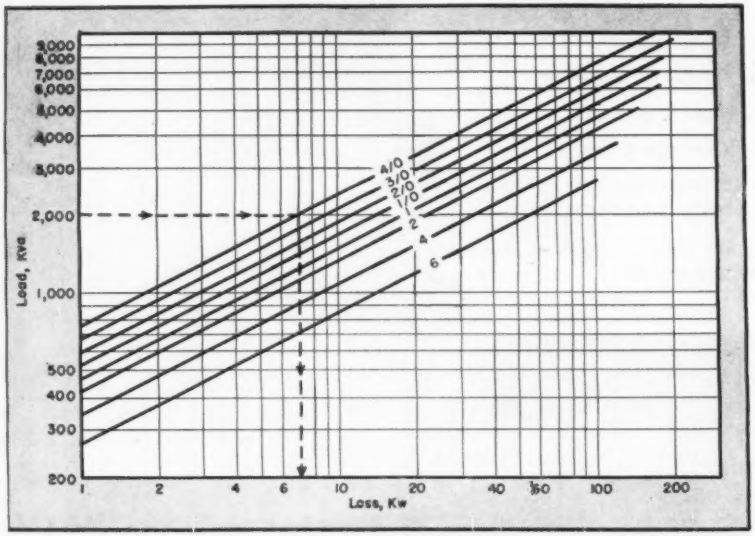
. . . OVER 50 YEARS OF LEADERSHIP IN DESIGN, RESEARCH, ENGINEERING

**MOLONEY ELECTRIC CO. ★ ST. LOUIS 20, MO.**

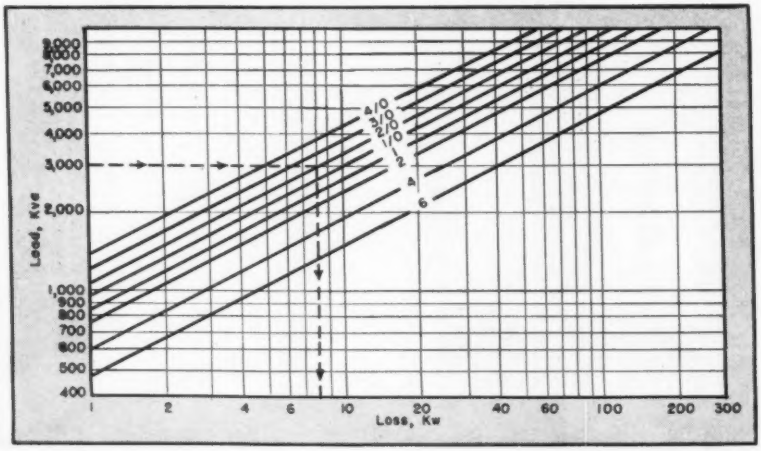
# Copper Conductor Power Loss For 12.47-kv and 22-kv, 3-phase Circuits

The kw per mile loss determined from the charts is for various copper conductor sizes and end-of-circuit loads

N. H. ERLANDSON, Distribution Design Engineer, Carolina Power & Light Co., Raleigh, N. C.




Power Loss in 12.47-kv, 3-phase circuits of copper conductors in eight sizes from No. 6 to 4/0. Example: 2,000 kva load on No. 4/0 conductors, 7.1 kw loss




Power Loss in 22-kv, 3-phase circuits of copper conductors in eight sizes from No. 6 to 4/0. Example: 3,000 kva load on No. 2/0 conductors, 8-kw loss

Note: For distances other than the basic distance for which the charts were made the losses vary directly with the length of the circuit, and for other values of load the losses vary as the square of the load.

Look closely at the jumpers on this strain tower... No splices! Conductor cable runs straight through without resorting to parallel jaw clamps to carry current and, eventually, to make trouble.

Construction like this is possible with O-B Hi-Lite strain clamps. It's easy to build, easy to inspect for soundness at any time, easy to keep in top condition. No special equipment, tools, or skills are required to install O-B Hi-Lites. A minute or two with a standard wrench and they're ready to serve the life of the line. Basically low in first cost, the O-B Hi-Lite installs at an attractive over-all saving.

Just add up these factors: Design that permits the use of continuous jumpers--convenience--high maintained holding power--positive inspection for soundness at any time--low installed cost--availability in either ferrous or non-magnetic, non-heating alloys. Don't you agree it's worth your time to investigate O-B Hi-Lite strain clamps?

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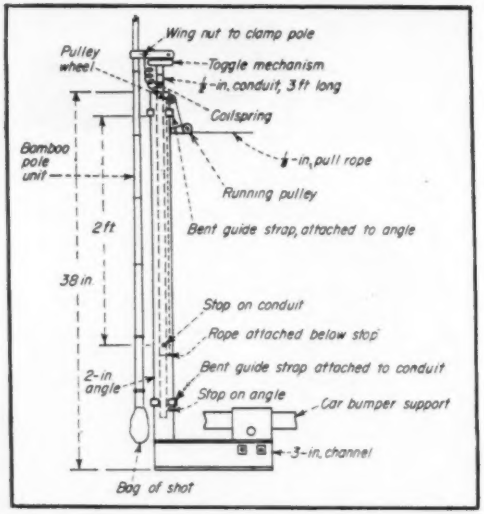
4110-M

# Check Crossing Clearances with Pole Mounted on Car

**POLE normally is 18 ft high for checking clearance of lines up to 750 v. Pole raises to 20 ft for lines 750 to 15,000 v. Pole top is marked to give distance below minimum clearance**




**MOUNT for measuring pole attaches to front bumper support of car. Conduit moves up and down inside angle iron. Stops on angle iron and on conduit fix positions of pole**


**D. STEWART**

**Inspection Engineer**
**The Potomac Edison Co**
**Hagerstown, Md.**


Wire crossing clearances over roads are quickly measured with a fish-pole attached by a special mount to front bumper support of a car. Using this device, a two-man crew of The Potomac Edison Co checked 7,982 crossings in 16 days, an average of about 500 crossings per day. In addition, this method permits measurements to be made from inside the car.

A 17-ft bamboo pole is mounted so that its tip is 18 ft above the road. In this position the clearance of telephone and power lines up to 750 v may be measured. By pulling a rope the operator can raise the pole to 20 ft for measuring clearances of lines from 750 to 15,000 v. To measure the height of crossings below minimum, the top 3 ft of the pole are marked off in 6-in. intervals by tape or alternate bands of color.

The pole is attached to a length of conduit (see illustration) by a hinged joint made from the toggle mechanism of an open type 7.5-kv dropout fuse switch. The conduit moves up and down inside an angle iron and is guided by fixed and sliding bent strap guides. A small bag of shot tied to the bottom of the pole and a coil spring attached to the hinge hold the pole in a vertical position when the car is stopped or moving slowly. At higher speeds, the pole lies back almost parallel to the road, allowing the car to pass under overhead obstructions.

# Cost Elements in Painting Steel Transmission Towers

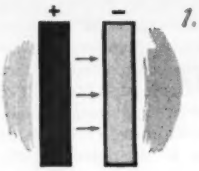
Data have been compiled for calculations of cost of painting steel transmission towers—both black iron and galvanized types. Estimates of painting costs can be made with a fair degree of accuracy. Data presented here and in an Engineering Reference Sheet* are the result of a compilation from numerous electric utility companies and experienced painting contractors. They are adapted from a forthcoming manual, entitled "Transmission Tower Painting," by Research and Technical Division, Joseph Dixon Crucible Co.

A 14-man crew is considered the most practical for painting towers. Three towers are painted at one time, using four painters on each tower. One painter is assigned to each of the four legs and is responsible for both cleaning and painting from the center of one span to the center of the adjoining span. One "ground man" is required for duties such as adjusting the rigging and keeping the painters supplied with necessary cleaning tools, paint and brushes. The 14th man is the supervisor or foreman. His responsibility is to see that the job is done in a manner to assure maximum protection at lowest per-year cost.

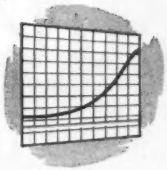
Combined experience of the utility companies indicate that an experienced painter can clean and paint from 280 to 370 sq ft of tower surface per 8-hr day; usable average is 340 sq ft.

On the basis that paint coverage

* See ERS No. 51-3 on page 78 of this issue.

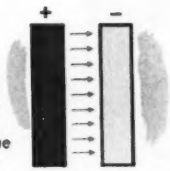



1. *Batteries on full float service require a small current to offset normal self-discharge. This self-discharge is due primarily to migration of antimonial impurities from the positive grids or grid frames to the negative plates.*



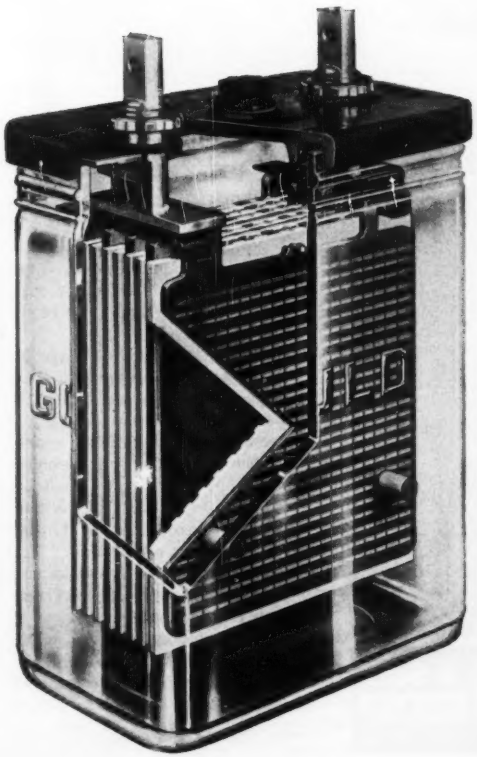
3. *Gould Planté Batteries contain no antimonial impurities. Therefore, their voltage requirements and capacity remain constant throughout their amazingly long, low-cost life.*

2. *In ordinary batteries as the self-discharge rate increases, more and more antimony is transferred to the negative plates. The cycle is repeated with increasing tempo until the positive grid fails completely.*



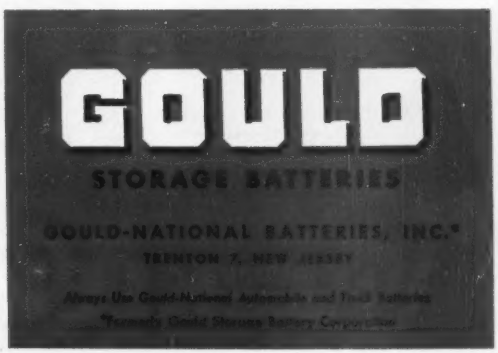

# GOULD PLANTÉ

## The Stationary Battery That Lasts Practically Forever!



**Because all of each positive plate is pure lead, Gould Planté Batteries stay in active service for 20 years, 30 years, and even longer! Nothing equals them for dependable, trouble-free service. They float at constant voltage and maintain rated capacity all their life. And, because they almost never need service, their maintenance cost is negligible. Choose**

**GOULD PLANTÉ**
**The Aristocrat of Stationary Batteries**



If you've ever been up on a 50-foot stick when your life depends on the quality of the belt and safety strap you use, you will appreciate the high quality and care that is so much a part of all Klein equipment. When life's at stake, there can be no compromise with quality. Old timers know that Klein equipment has stood for quality in linemen's tools and equipment—"since 1857."

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ranges from 360 to 400 sq ft per gal, a usable average is 380 sq ft per gal. Accordingly, the paint consumption is 0.9 gal per painter per day.

Direct labor cost per 1,000 sq ft of surface cleaned and painted (one coat) can be estimated.* The labor cost can also be determined by the formula:

$$C = 8{,}000\ W/c$$

where $C$ = cost in dollars per 1,000 sq ft, $W$ = hourly wage rate in dollars, and $c$ = coverage in square feet per painter per 8-hr day.

A mathematical relationship between the surface area of a tower and its weight ranges between 0.14 and 0.20, with 0.17 as a usable average. The accompanying table, based on this average ratio, shows the surface areas of towers of various structural weights which range from 8,000 to 40,000 lb.

Areas of Towers for Various Structural Weights

| Tower Weight (lb) | Computed Surface Area of Tower (sq ft) |
|---|---|
| 8,000 | 1,360 |
| 10,000 | 1,700 |
| 12,000 | 2,040 |
| 14,000 | 2,380 |
| 16,000 | 2,720 |
| 18,000 | 3,060 |
| 20,000 | 3,400 |
| 24,000 | 4,080 |
| 28,000 | 4,760 |
| 32,000 | 5,440 |
| 36,000 | 6,120 |
| 40,000 | 6,800 |

Data based on the relationship: area (sq ft) = 0.17 × weight (lb)

Cost of paint per 1,000 sq ft can be calculated for various purchase prices,* using a coverage value of 380 sq ft per gal.

Direct supervision costs range between 10 and 15% of the total direct labor costs. A usable average is 12% on the basis of a 14-man crew.

Overhead, including initial cost of equipment plus required replacement of items due to wear and breakage, is estimated to be 15% of the total costs including overhead (or 17.65% of all costs before overhead).

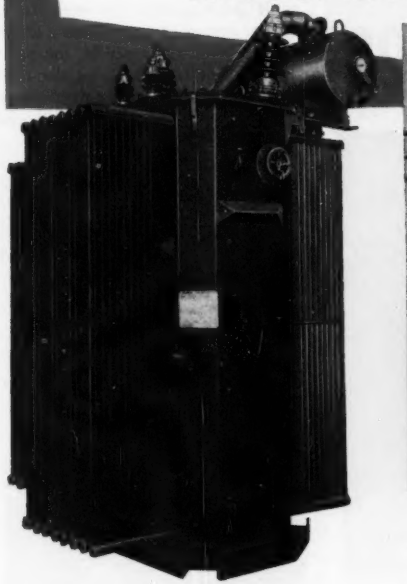
Insurance has been found to cost about 1% of the combined direct labor and supervisory costs.

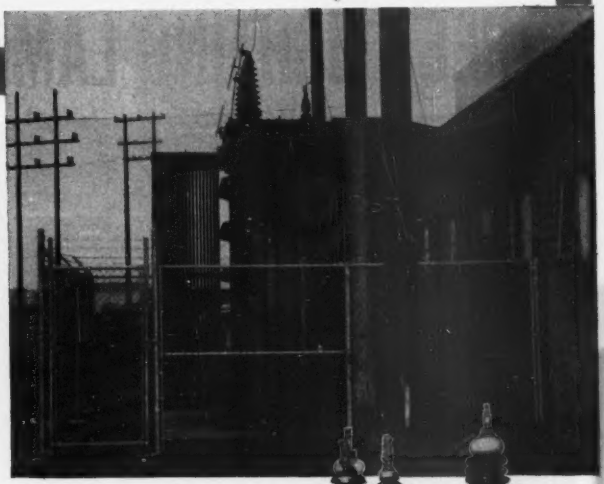
An acceptable overall average life expectancy in the case of transmission towers, as a very broad average, may be assumed to be five years. This is

* See ERS No. 51-3 on page 78 of this issue.

# Wagner Transformers

## ...best choice for Rural Systems





7500 kva, three-phase Wagner Power Transformer in the substation of a generating co-op in the Northwest.

### . . . They have the stamina to perform dependably under ever-increasing loads

Wagner Transformers are favorites with hundreds of rural line systems throughout the country. Whether you need power transformers for generating plants—substation transformers for feeding distribution lines—or pole type transformers along the lines . . . you can't beat Wagner Transformers. They require only a minimum of attention, and they have a nationwide reputation for long life and stamina. This reputation is backed by service records from the field and by sixty years of transformer building experience.

Above is a 2000 kva Wagner Power Transformer.

At right is pictured a Wagner single-phase Substation Transformer—like those serving with complete dependability on rural line systems everywhere.

If you are planning to increase the capacity of your system, check the many advantages of Wagner Transformers. Bulletins TU-180 and TU-181 give full information. Be sure to get your copies.

Wagner Electric Corporation
1891 1951

TU-4

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MANY OF THE LARGEST American municipalities and public utilities have standardized on Amplex Street Lighting Lamps both for superior lighting and for the extraordinary savings that they bring to every installation. These lamps are specially designed and built to survive the vibration and shock of road traffic and to maintain a maximum percentage of light output throughout their long-burning life.

Amplex offers you the most complete line of street lighting lamps ever put on the market . . . a type and wattage for every kind of service. Among these, Amplex Weatherproof Bulbs are probably today's fastest-growing specification. Amplex Weatherproof Lamps are formed of "hard glass," ending failures due to climatic conditions . . . providing maximum dependability and savings.

For full facts about Amplex Street Lighting Lamps and their superior performance, write Amplex Corporation, Dept. J-1, 111 Water Street, Brooklyn 1, New York.

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in view of the number of variables. In the collected data, extremes of paint life were found to range from 2 to 12 years.

As to tower painting economies, a cost analysis shows an interesting relationship between the actual cost of the paint and the total cost of the entire painting job. For example, at a paint cost of $4 per gal and a direct labor cost of $2.25 per hr, the paint will account for 12.7% of the total cost. Or, at $4 per gal but with a wage rate of $2.75 per hr, paint will account for 11.6% of the total cost.

Painting costs for various tower weights and surface areas, and total cost per year for an average paint life of five years, have been computed.* A chart showing relationship of price and life of paint to cost of tower protection per year will appear in an ensuing issue.

* See ERS No. 51-3 on page 78 of this issue.

## Gas-Cable Pipe Welded With Cable in Place

**RECTANGULAR PATCH** was welded to pipe holding 138-kv cable while three-conductor cable was still inside


**RALPH PIERCE**
**Senior Engineering Assistant**
**Cable Div, Underground Lines Dept**
**The Detroit Edison Co, Detroit, Mich.**


Fast trouble-shooting, plus welding of a patch on the pipe of 138-kv pipe-type cable with cable in place, let Detroit Edison employees restore service on the circuit less than 24 hr after the pipe was tapped inadvertantly by crewmen on another project. The mass of underground structures was

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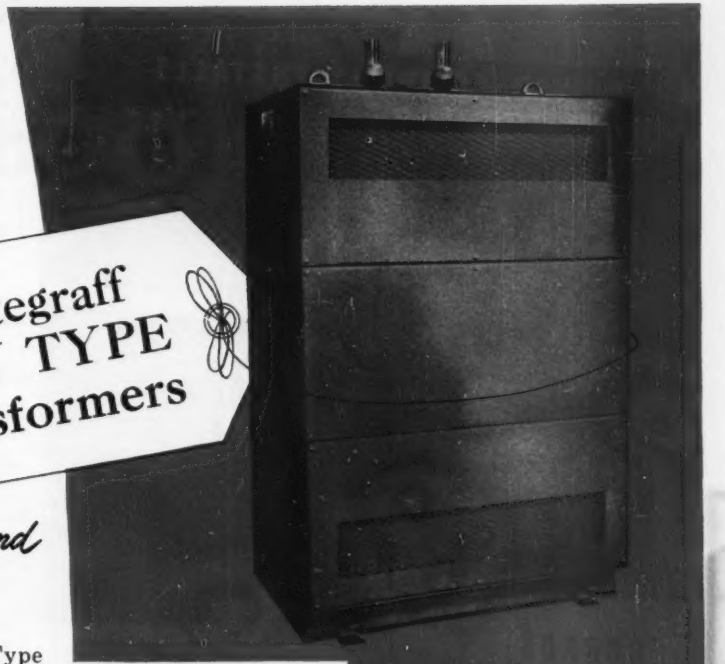
OF

# Uptegraff DRY TYPE Transformers

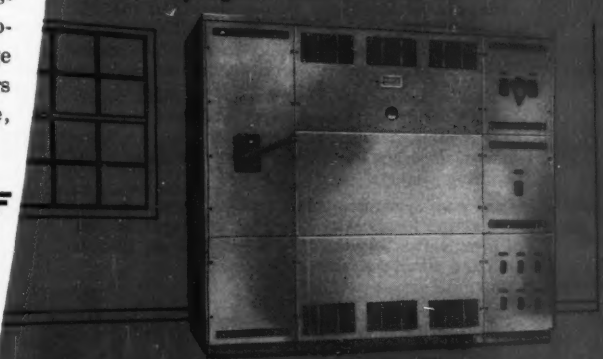


*Saves money and Time for You!*

Because Uptegraff Dry Type Transformers are safe to install anywhere and are light in weight, they do not require special rooms, enclosures, heavy foundations or floor supports. Initial cost is low, installation is relatively simple. Long, expensive bus runs are avoided because they can be located at or near the load center.

Flexible in operation and safe for installation wherever desired, this Uptegraff Dry Type Transformer is economical and dependable. Unit shown is 333 KVA, single phase, 2400/4160 Y-120 volts, tap from 2½% to ±5%. View at left shows cover panels removed.

The Uptegraff Unit Substation



Includes transformer and switching equipment in one compact, factory-wired, unit assembly. Designed and built to individual requirements.

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**MANUFACTURING CO.**
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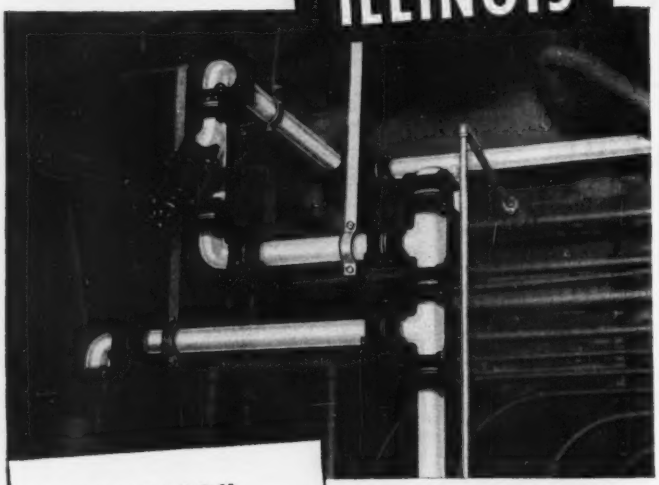
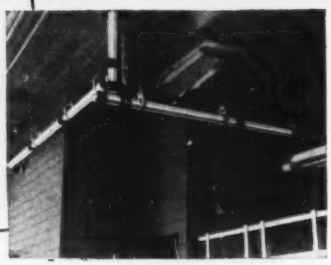


CORROSION RESISTANT PORCELAIN PIPE, VALVES AND FITTINGS!



CENTRAL Illinois Public Service Company uses Illinois chemical porcelain pipe, valves and fittings in its Meredosia Power Station at the discharge of alum treating tank. Other Illinois installations at this station include the vent and drain piping from the battery room, and laboratory drain.

Illinois chemical porcelain's non-absorbent super-smooth inside surfaces prevent wear and abrasion and combined with its strong, fracture-resistant walls make it the ideal material for *permanent* fluids handling systems.

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given as the reason for the mistake.

When the drill of the tapping machine penetrated the pipe, it was apparent that the pipe contained gas instead of liquid. At about the time this was discovered, the high pressure within the pipe blew out the sealing gasket between the pipe and the saddle on the tapping machine.

When the first hole was made in the pipe, the pressure recording instrument at the substation began to show a slight drop. The pressure dropped rapidly when the gasket was blown out.

When pressure in the pipe dropped, the line was taken out of service and men were dispatched to patrol the line. From the drop in presure it was obvious that the leak would be audible and probably visible, that is, in an excavation or manhole. After the leak was located and by the time workmen, tools and equipment were dispatched to the job, gas in the pipe had blown down to atmospheric pressure.

A rectangular opening, 3x5 in., was cut in the pipe at the damaged spot. Inspection of the cable showed that the tapping drill missed all three conductors. After covering the conductors with aluminum foil to reflect the heat of welding, a rectangular patch was electric welded in place. Length of seam continuously welded was limited in order not to build up excessive heat which might damage the cable. The pipe was ready to receive the gas by 9:30 pm and the line was ready for service at 11:30 am the next day. About 105,000 cu ft of nitrogen were pumped into the line to establish a pressure of 204 psi.

Electrical World's

**STATISTICAL ISSUE**

". . . the industry's basic reference sheet"

will be published

**JANUARY 29th**

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# LOAD BUILDING

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## Lighted Pen Adds Pounds to Pigs During the Night

**FARMER QUIGG learned that if pens were lighted pigs would "work," that is be up and around, eating and going to the water trough. Result, they fatten and are ready for market some weeks earlier. To prove this to himself Mr. Quigg divided his pigs into two groups, lighting the pens of the experimental group at night**

Farmer Halfred Quigg in Hamilton County, Ind., accidentally discovered that pigs would rather eat then sleep —if the pen is lighted. And when they are eating at night they are getting fatter quicker. He found that out too.

Coming home from a movie late one night Farmer Quigg noticed a light in the barn and went out to see why. He had just forgotten to turn out the light. But he also found that the pigs were up "working," eating and going to the water trough.

It started him to wondering. If pigs would rather eat than sleep, if the light were on, would they fatten and get ready for market quicker if he lighted the pen at night. Farmer Quigg started an experiment. He divided his pigs and for one half he lighted the pens at night. Result, the half in the lighted pens was ready for market some weeks ahead of the others.

## Infrared Heaters Keep Food at Serving Temperature

Two 1,000-w infrared heaters keep food at serving temperature all the time at each of the two Courtney's restaurants in Atlanta, Ga. Food is served hot and customer complaints from rejected cold food are non-existent. The heaters contribute to more efficient cooking and serving and permit more meals to be served during rush hours—especially when pick-up is sometimes delayed while the waitresses are writing orders.

The plates remain at a comfortable handling temperature and foods are said to maintain their moisture.

Heaters are hung by chains from the ceiling. A tumbler switch on the connection box at one end serves as a handy control point. Flush wire guards protect the infrared heating elements from accidental contact. The heaters are operated almost continuously during the restaurant work day from 7 am to 11 pm.

**FOOD IS KEPT HOT at all times and restaurant efficiency increased by these two 1,000-w infrared radiant heaters suspended above a serving table in the kitchen. More meals can be served during rush hours with no complaints due to cold food. The heaters take care of the period until food can be served by busy waitresses**

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**WHERE IT'S HOT—**
"Dual-Rated" is Underwriters' Laboratories approved as Type RH at 75°C., dry locations... **or**

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# Home-Made Electric Scalder Eliminates "Hotfoot"

**L. L. KOONTZ**
**System Rural Supervisor**
**Appalachian Electric Power Co**
**Roanoke, Va.**

Here is a home-made electric poultry scalder that not only does a better job of scalding turkeys but also has eliminated the "hotfoot" its maker got when he scalded turkeys in the old flame heated pot. In the past, Fred Wampler of Franklin County had scalded his turkeys in an old iron kettle, heating water by a wood fire. He was forever building up the fire when the water was too cold and pulling the fire out from under the kettle when the water was too hot. This took a lot of time and attention, yet he still couldn't keep the water at the proper temperature to get a good scald—so important in dressing a first-class turkey. Moreover, Wampler was always standing too close to the fire when scalding, and either got himself a "hotfoot" or set his pants legs afire.

Wampler talked over the problem of scalding turkeys with J. W. Hall, Appalachian Electric's Roanoke District Agricultural Engineer and a home-made device was recommended along with plans for making it. A neighboring farmer with an electric welder, did the necessary welding on the scalder. Wampler installed the heating element, thermostat and insulation himself according to Hall's instructions. Several similar poultry scalders have been built by farmers in the Roanoke area using similar plans.

**ELECTRIC POULTRY SCALDER keeps water at proper temperature and eliminates fire building and "hotfoot" attending old open flame method. Two 2,500-w heating elements and 30 and 50-gal drums are used in the scalder**

Plans for the regular poultry scalder consis. of using one 30-gal drum and one 50-gal drum, heating element, thermostat and insulating material. The top third of the 30-gal drum is cut off to give a 20-gal capacity. A hole is cut in one end of the 50-gal drum large enough to slip the 30 gal drum into it. Top of the 30-gal drum is welded to edge of hole. Insulating material such as mineral wool is placed in the space between the two drums. A 2,500-w, 230-v immersion heating element is fastened into a side of the 30-gal drum approximately 1 in. from the bottom. Heating element is controlled by a bulb-type thermostat fastened on the outside of the 50-gal drum. Capillary tube is tied down close, but not against, the heating element.

The Wampler scalder varies from regular scalder described above, in that the full 30-gal drum was used to give 30-gal capacity, and two 2,500-w heating elements were used in order to take care of an above-average rate of scalding. Wampler will use it this year to scald approximately 3,000 turkeys. He has scalded as many as 250 turkeys in one day with his home-made equipment and can probably do many more if help is available.

The scalder can be made for approximately $35 to $40—considerably less than a commercially-built unit of same capacity, and which is very hard to find at present. This device has given excellent results when used with electric poultry pickers. The thermostat keeps water at proper temperature for best picking. This cannot be obtained under open-flame method. Much interest is being shown in the home-made poultry scalder and it is felt that poultry farmers who dress 20 or more birds at a time will find it a low-cost time and labor saver.

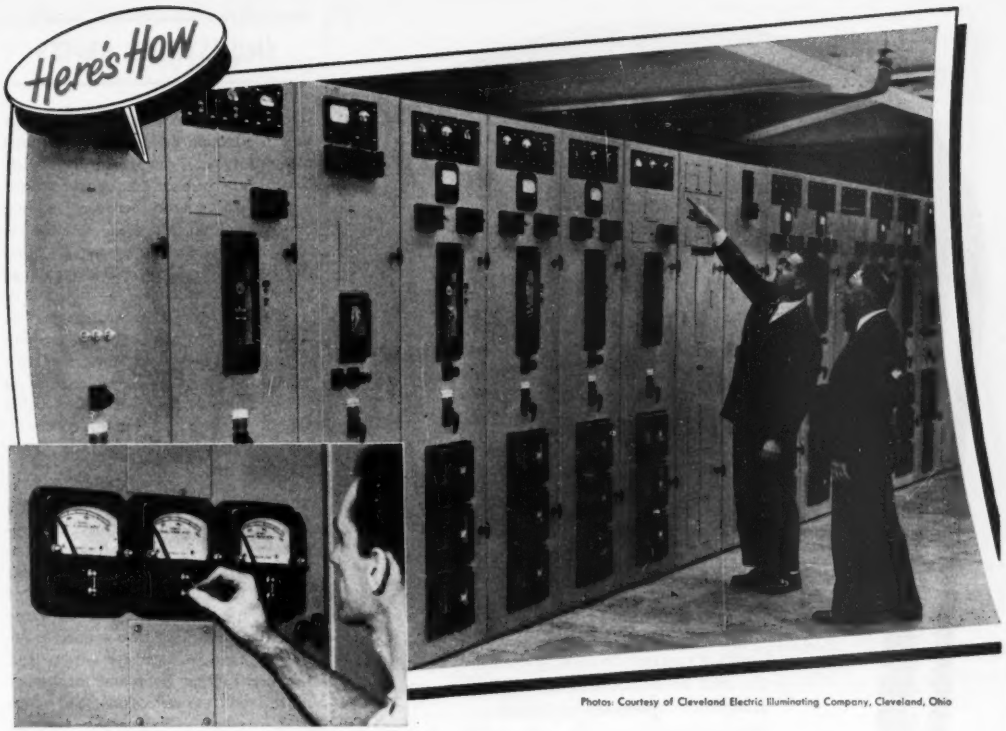
# Infrared Oven Triples Slipper Dehydrating

Production has been increased 300% and valuable floor space saved by the installation of an infrared oven for dehydrating slippers at the L. B. Evans Co, Wakefield, Mass. The hand turned slippers are now dehydrated after relasting for final finishing, at the rate of 2,400 pairs per 8-hr as compared with 800 pairs for the same period by the formerly-used method. The time factor with the infrared oven is 9 min compared with 3 to 4 hr previously. The company saves the use of

**INFRARED DRYER dries 2,400 pairs of slippers in 8 hours compared with 800 pairs by the previous method. Ceiling suspended oven saves floor space**

100 racks, each holding 24 pairs, which were necessary for storing the slippers prior to drying. Since the oven is suspended from the ceiling the floor space previously required for the old oven is now made usable for other purposes. It was often necessary to operate the old oven 2-hr daily in order to get the required production.

Oven is 51 ft 4 in. long and is lamped with 56 kw of G-30, 375-w lamps. Slippers are spaced 6 in. apart on conveyor.




Photos: Courtesy of Cleveland Electric Illuminating Company, Cleveland, Ohio

# You can solve the problem of keeping loads balanced...

## LINCOLN Thermal Ampere Demand Meters

Because of today's constantly changing load requirements, you get the most out of your distribution system only when you keep loads between feeders balanced on the basis of *continuous* ampere demand information.

Permanently installed Lincoln Ampere Demand Meters give you the continuous measured facts. They show the value of current which remains on the feeders long enough to affect the carrying-capacity of the lines and distribution equipment. They're economical, too,—their cost is often paid for in one year by eliminating periodic surveys.

Lincoln Ampere Demand Meters are available for indoor and outdoor substations. When desired these meters can be furnished in types incorporating a self-contained ammeter to show immediately whether the load has been picked up when the feeder switch is closed. For full information, write for Bulletins 461 and 467.

**Sangamo J Meters**

These watthour meters meet today's requirements and tomorrow's anticipated loads with sustained accuracy, economy of maintenance and troublefree performance.

*Only Measured Facts are Known Facts*

**SANGAMO ELECTRIC COMPANY**

SPRINGFIELD, ILLINOIS

EM51-4

Speed-up

RACEWAY RUNS WITH

BERMICO®

FIBRE CONDUIT!

Running a raceway can now be done much faster and easier—because when you use Bermico Fibre Conduit you can do cutting and tooling right on the job! Its 8-foot lengths are light . . . easy to handle . . . speed-up installation.

Bermico gives you **High Mechanical Strength.** Tough and resilient, it offers the best possible protection against accidental damage to wiring.

Bermico's **Complete Line of Bends,** plus 5° angle couplings, enables you to meet unusual field conditions.

You get **Easy Cable Pull,** too. Bermico's unusually smooth bore prevents chafing or injury to wires or cables being pulled through . . . provides speedier fishing.

Use Bermico Fibre Conduit on your next construction job—to secure long service at lower cost.

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## INDUSTRIAL BRIEFS

**Heat Treating of Cable** in continuous line production saves time and assures uniformity at Teleflex, Inc, Philadelphia, Pa., by high frequency current heated coil placed between winding and spooling processes. Cable is heated instantaneously as it flows through coil and gets quick quench as it enters oil bath directly beneath it. It saves time in transporting coils to other departments for heat treating commonly done by other methods, produces uniform characteristics in cable, and sets outer strands of cable without affecting inner core.—L. Albertson, application engineer, Philadelphia Electric Co.

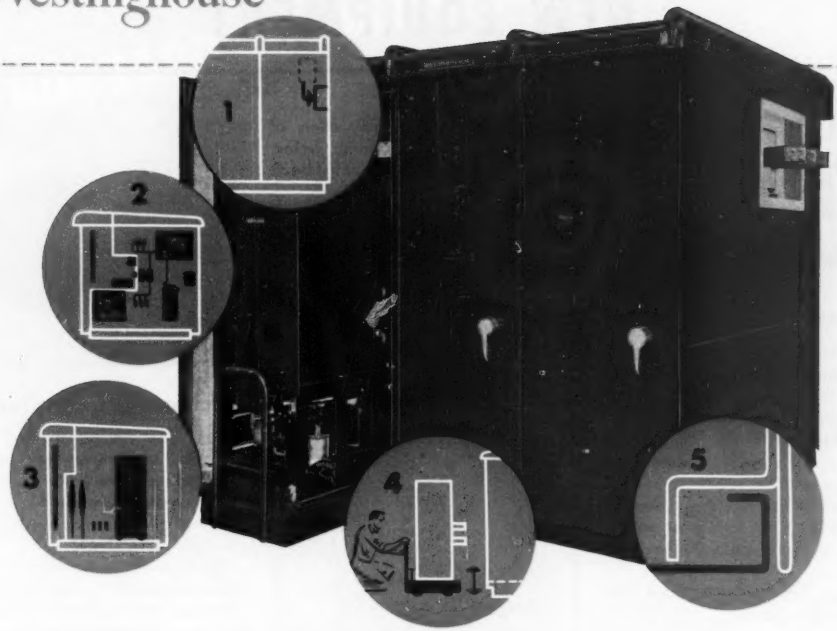
**High Level Lighting** in the Macon Textile, Inc, mill of Macon, Ga., provides average of 35 to 40 ft-c. Continuous rows of recessed fluorescent troffers in weaving area and rows of industrial fluorescent units in large spinning room improve worker's efficiency and reduce eye strain and fatigue. Lighter floor and machinery finish reduces reflections and contrast.—Industrial Power Div, Georgia Power Co.

**Electric Melting** arc furnace for copper cathodes for casting billets used in making copper tubing at the American Smelting and Refining Co, Baltimore, Md., improves quality of product and lowers production costs over formerly-used oil-fired furnaces. Working conditions have been improved. Plant is cleaner and cooler. Installation consists of 6,000-kw melting furnace with 20 tons per hr capacity and a 125-kw induction type holding furnace.—Industrial Power Dept, Consolidated Gas, Electric Light & Power Co of Baltimore.

**Stock Panel Bonding** operation at Rway Furniture Co, Sheboygan, Wis., has been made completely automatic by dielectric heating. Glue lines are evenly and rapidly cured. Output rate is up to 10,000 sq ft of stock in a two shift, 18-hr day. Operator's only duty is to load feed belt and remove finished panels. Time cycles range up to 40 sec, depending on stock. Panels can be bonded in multiple lengths or widths, or both. Costs have been sharply cut. Set-up time when changing load sizes is less than 5 min.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse




# Westinghouse Outdoor Switchgear gives you 5 NEW OPERATING ADVANTAGES

Westinghouse brings you redesigned 5-Kv Outdoor Metal-Clad Switchgear with improvements that add up to time and cost savings in installation, operation and maintenance.

Greater accessibility of operating parts . . . better ventilation and weatherproofing . . . improved appearance are among its advantages that give you more for your switchgear dollar.

1. Control knife switches are in easy-to-reach position.
2. Auxiliary compartments provide better equipment access. More headroom makes inspection and maintenance easier.
3. Enclosure makes possible use of two potheads for two 3-conductor cables without sacrificing the full-length instrument panel. Adequate clearance is afforded behind the panel at the pothead elevation for semi-flush Flexitest cases and average-depth Type W switches.
4. Platform height is adjustable. Transport truck provides adjustability for slight variations in pad level.
5. Newly designed doors with flanged edges provide extra rigidity and improved weather seal.

Get complete facts from your nearby Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

* * *

*See "Electrical Proving Ground" . . . the dramatic story of the Westinghouse High Power Laboratory in sound and color motion picture. For details, write Westinghouse Film Division, Box 868, Pittsburgh 30, Pennsylvania.* J-60743

Westinghouse

METAL-CLAD SWITCHGEAR

# NEW EQUIPMENT

## Protective Gap

Auxiliary surge protection for substation equipment rated 12 kv and above is said to be provided by a new line of entrance protective gaps, called Guard-O-Gap.

Among advantages claimed for these gaps are:

**1.** They mount directly on line entrance switches or on top of substations with minor additions to structures.

**2.** Gaps are easily adjusted and maintain their spacing.

**3.** Gap electrodes are shaped to provide magnetic movement of follow current arc upward along the electrodes and away from the sparkover point. Accuracy of gap setting is preserved because all burning of electrodes is confined to the tips.

**4.** When mounted on air break switches, tilting the horns at an angle of 45 deg outward from the switch causes gap to force the arc away from switch components.

Type H-45° 3-phase Guard-O-Gap arrangement for mounting on line entrance switches is illustrated.

**Royal Electric Mfg Co Inc, 1122 E. 87th St, Chicago 19, Ill.**

•

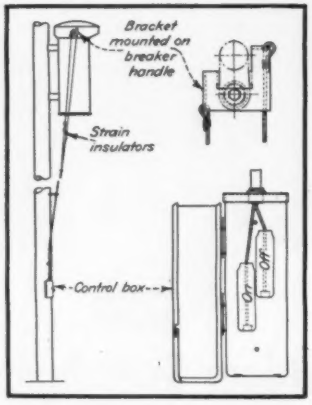
## Water Fog Fire Protection

Fires in oil-filled transformers, switches, etc, reportedly can be extinguished by use of a water fog producing device developed for use in fixed piping systems. As a non-conductor of electricity, water fog is said to allow installation of the Fogheds—as the device is called—relatively close to the hazardous equipment.

Principle of operation is that water broken into extremely small particles of uniform size absorbs great amounts of heat, preventing vaporization of the transformer oil during arcing. Foghed is UL-approved for Class B and C hazards.

**Akron Brass Mfg Co, Fog Nozzle International Div, Inc, Wooster, Ohio**

•




## Transformer Control Device

Breaker reset handle of pole mounted CSP transformers can be operated from ground level with a new control device. It is especially useful for turning on and off sports lighting, or for other special applications where power is supplied through CSP transformers.

Two control cables are attached to a special bracket mounted on the breaker handle. These run down the pole in conduit and terminate in a control box mounted on the pole at a convenient height above ground. Strain insulators eliminate possibilities of voltage in the control box.

Operation is by pulling steadily on one of the handles attached to the cables until transformer breaker handle assumes "on" or "off" position. Breaker can also be seset after automatically tripping. The two styles available are for transformers rated 3 through 25 kva and 37.5 through 100 kva.

**Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.**

## Synchronous Generators

Four basic designs of the Tri-Clad high-speed synchronous generator line have ratings from 1.875 to 50 kva. Three standard types—ATI, ASI, and ATB—of 60-cycle and one 400-cycle generator are available.

The basic 60-cycle design is an externally-regulated generator designed to operate with standard voltage regulator in the exciter field circuit. Available are excitation voltages of 64 v (standard) and 125 v. Sixty-cycle ratings vary from 2 kw, single-phase, to 15 kw, 3-phase.

A modification of the basic 60-cycle line provides self-regulated features for applications where average voltage regulation and motor starting ability is desired. Ratings range from 1 kw, single-phase, to 10 kw, 3-phase.

For close voltage regulation and excellent starting ability, the third 60-cycle line involves the basic generator, overhung Amplidyne exciter, and static voltage regulator in one package.

The 400-cycle, 14-pole generator is meant for military ground power engine- or motor-generators sets, testing laboratories, textile mills. Ratings available are from 2 kw through 40 kw.

**General Electric Co, Apparatus Dept, Schenectady 5, N. Y.**

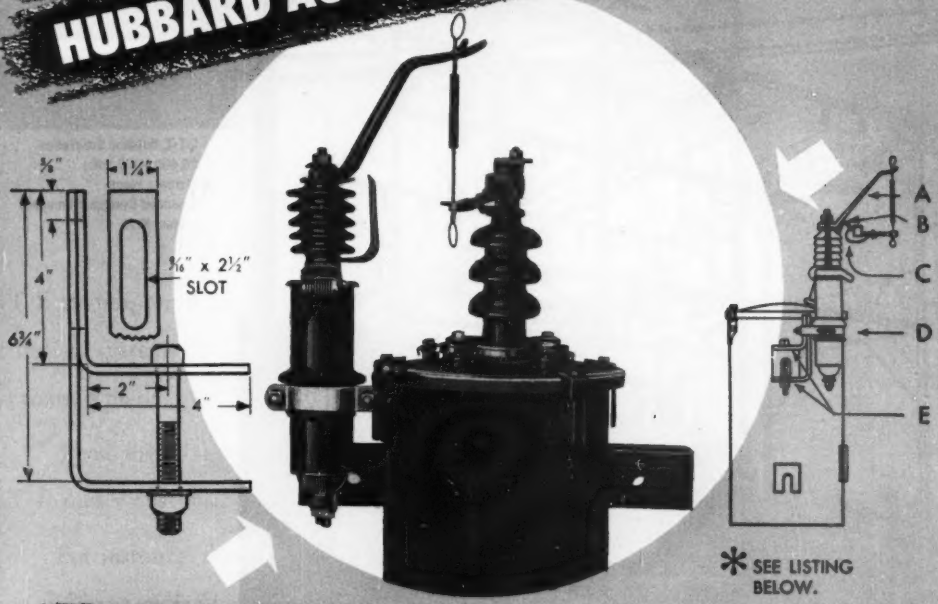
•

## Tube Expansion Control

Expansion of heat exchanger and condenser tubes is automatically stopped when the tube is properly

(*Continued on page* 100)

# HUBBARD AUTOGAP FUSE KITS




# GIVE—COMPLETE PROTECTION

Hubbard Autogap Fuse Kits provide transformer protection with external accessibility. All parts are easily inspected. The fuse link is exposed, making it easy to select the right fuse for proper coordination. Transformer and kit can be assembled on the ground and mounted as a single unit. Kits for Vertical and Horizontal Autogaps are also available for factory assembly.

*

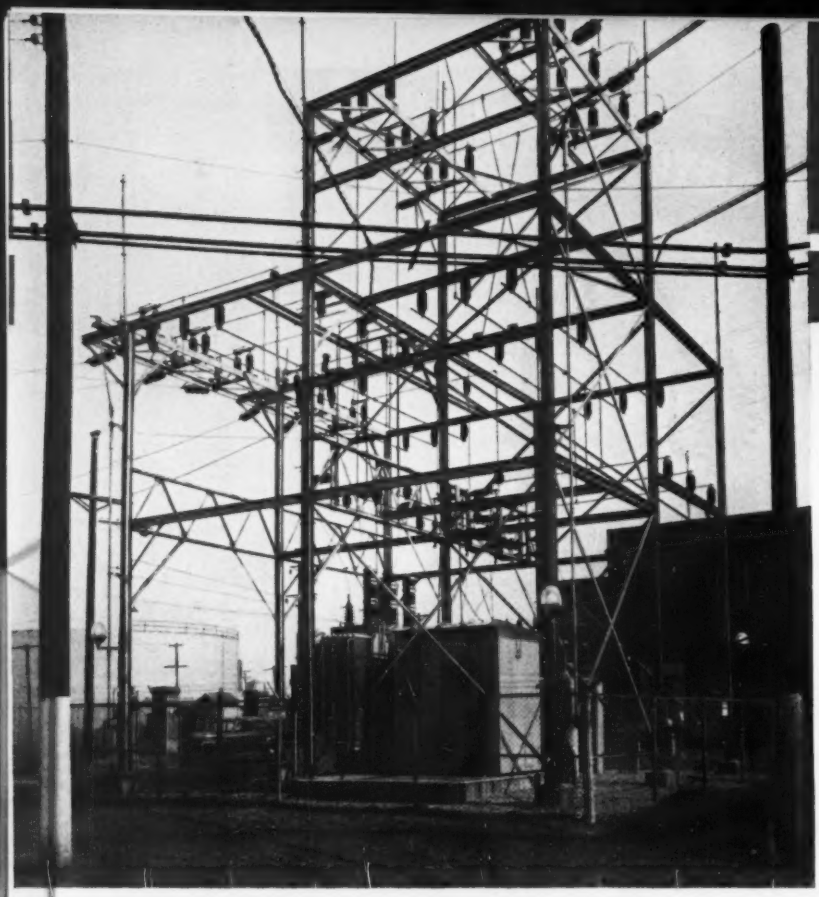
| | |
|---|---|
| A | *Bronze Fuse Fork* |
| B | *Terminal Lug Adapter* |
| C | *Chrome Steel Spring Assembly* |
| D | *No. 2332-9kv Autogap Arrester* |
| E | *Heavy Duty Adjustable Mounting Bracket No. 2349* |

**HUBBARD AND COMPANY**

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

*"Hang the Load on Hubbard Hardware!"*



I-T-E Outdoor Substation
26,400/4160 volts
Warners Plant
American Cyanamid Company
Linden, N. J.

5-KV-150 I-T-E Switchgear
Pearl River, N. Y. Plant
Lederle Laboratories Division
American Cyanamid Company

# I-T-E AT AMERICAN CYANAMID...

I-T-E switchgear is part of power distribution systems in several American Cyanamid plants.

These installations illustrate how I-T-E meets customer needs.

For instance, the outdoor substation at Cyanamid's Warners Plant demonstrates how I-T-E can accept unit responsibility and furnish all the equipment on one order. And at the Lederle Laboratories Pearl River Plant, the 5 KV switchboard – tied in with a public utility substation – demonstrates I-T-E's ability to furnish switchgear for operation with other equipment.

Whether it be unit substations or 5 KV switchboards, individually enclosed circuit breakers or load centers, I-T-E is prepared to handle *your* switchgear application – and meet *your* needs!

*For information about I-T-E Multumite Switchgear, send for Bulletins 6003-D and 7000-A. Or call your local I-T-E representative. He will be glad to help you.*

I-T-E

**For *more dependable* Switchgear**

*specify I-T-E!*

R&IE

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment • Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • REACTORS • SPECIAL PRODUCTS

# MARCUS
## DRY TYPE TRANSFORMERS
## exclusively!

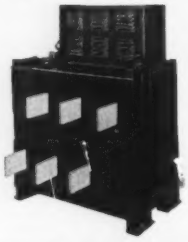
THE MARK OF QUALITY
MTC

**TYPE ACO**

All purpose, indoor or outdoor, dry type distribution transformers. Sizes to 100 KVA, voltages to 5000 V.

**TYPE C**

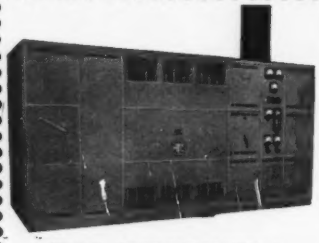
General purpose transformers, 600 volts and below; 1-15 KVA inclusive, single or three phase completely self contained.



**FURNACE TRANSFORMER**

3 PHASE, 3/2 PHASE, 1 PHASE

Uses—Forging, heat treating, melting, resistance heating, welding, etc.



**TYPE F - UNIT SUBSTATION**

1000 KVA, 4160Y 60 Cycles, 3 Ø —480 delta; Fused, load interrupter on H.V. (left). Drawout type breakers and metering equipment on L.V.

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY

1 to 2,000 KVA up to 15,000 Volts to meet Individual Requirements

- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

**MTC produces a complete line of quality transformers to 2000 KVA. A newly expanded plant with the most modern equipment, plus a background of years of dry type specialization, assures maximum transformer value.**

NEMA

MARCUS TRANSFORMERS CONFORM TO THE STANDARDS OF N.E.M.A. AND A.I.E.E.

Representatives in Principal Cities

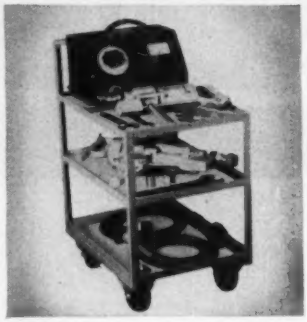
MTC

**MARCUS TRANSFORMER CO.**
INC.
30 MONTGOMERY STREET
HILLSIDE 5, NEW JERSEY

PIONEERS IN THE FIELD OF AIR COOLED TRANSFORMERS


## New Equipment

(*Continued from page 96*)



rolled through use of a control unit used with the tube expansion equipment, manufacturer reports. Uniform results are obtained because the control is precalibrated and may be set for the tube sheet thickness being worked.

The mobile unit consists of a welded steel frame truck on which the control system, extra motors, expanders, mandrels, cables and accessory tools are placed on shelves to make them easily accessible. Four different electric motors available for use with the control will furnish the range of power needed for all industrial tube rolling needs. The photograph shows the control box with different-size motors on the top and the middle shelf.

**The Airetool Mfg Co, 362 S. Center St, Springfield, Ohio**

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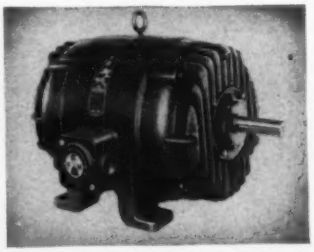


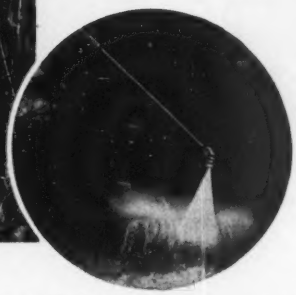
### Induction Motors

Continuous duty ratings of Type QZE totally-enclosed non-ventilated, squirrel cage induction motors are now available in NEMA standard frame 284. Ratings in production are 7½ hp, 1,800 rpm, and 5 hp, 1,200 rpm.

Mounting dimensions are identical to those of standard totally-enclosed, fan-cooled motors of the same ratings. Ball bearings are of the cartridge type

# ESTERON 245 for basal bark spraying

## controls brush and trees!



Now you can plan in terms of a *year-around* brush control program! Basal bark applications with low-volatility Esteron 245 in diesel oil or kerosene have given as good control of brush as summer foliage treatment. Esteron Brush Killer, another low-volatility ester formulation, may also be used at higher concentrations.

Basal bark treatment—spraying only the basal portions of brush stems or tree trunks—controls most woody species, including those which have shown resistance to foliage sprays. The big advantage is—basal spraying may be done *any month in the year,* while foliage treatment in most locations is limited to four or five months. A second advantage is that low-cost hand equipment can be utilized. Complete coverage does the job. This means wetting thoroughly (completely encircling) the base of the stems or trunks to a height of 12 to 18 inches from the ground line. Both Esteron 245 and Esteron Brush Killer are useful also for spraying cut stumps to prevent resprouting. This, too, may be done at any time during the year, wetting the complete stump to the ground line, including all exposed bark and above-ground roots.

The *proved* success of basal bark treatment makes possible a twelve-month spraying schedule. This outstanding development is a result of extensive experiments over a five-year period by Dow's Field Research division—plus field trials under the supervision of Dow's Technical Service and Development division. Your inquiries are invited. Dow sales and technical men are available for consultation and assistance.

*Write for Booklet IN-168*

## ESTERON 245 *and* ESTERON BRUSH KILLER

**Containing new low-volatility ESTERS**

AGRICULTURAL CHEMICAL DIVISION

**THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN**

**USE DEPENDABLE DOW AGRICULTURAL CHEMICAL PRODUCTS**

WEED, BRUSH AND GRASS KILLERS • INSECTICIDES

FUNGICIDES • PLANT GROWTH REGULATORS

GRAIN AND SOIL FUMIGANTS • WOOD PRESERVATIVE

DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY AND AGRICULTURE

STATES TESTING EQUIPMENT

# TEST TABLES

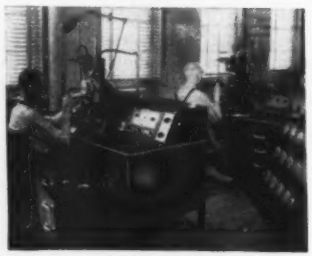
- To Cut Meter Testing Costs
- To speed up output
- To make testing easier

Form FRSS

Equipped with combined Stroboscopic and photo-electric test equipment.

New Way of Testing—By a Beam of Light

Old Way: — When a meter tester is counting disc revolutions — he can't do anything else.



Two Form "FRSS" Strobo and Photo-electric Tables in operation.

Test Tables for checking Watthour Meters, Relays, Transformers See Cat. 1 Sec. 3E

THE STATES COMPANY

-------- TEAR OFF AND MAIL TODAY TO --------

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Please mail Test Table Catalog to

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Firm .....
City ..... State .....

with ample grease space to permit sealing for the life of the bearing if desired. Symmetrical construction permits reversal of stator if it is necessary to change the relative position of the conduit box. Additional information is in Bulletin 1215.

**Fairbanks, Morse & Co, 600 S. Michigan Ave, Chicago 5, Ill.**

•

## Breaker-Receptacle Unit

Magnetic circuit breakers as well as receptacles in a single compact unit form the Special Purpose Unit. The receptacles are already wired-in for the user's convenience, so that the only connections necessary are those directly to the line. Temporary circuits for such apparatus as drills, sanders, motors, pumps, compressors, floodlights, etc, are established by plugging in the equipment to the convenience outlets.

This equipment is available with one to four fully magnetic breakers in combination with one or two receptacles. Ratings are supplied in any combination up to 50 amp each. The covers can be padlocked to prevent tampering with the equipment. Bulletin EB 2013 presents additional information.

**Heinemann Electric Co, 98 Plum St, Trenton 2, N. J.**

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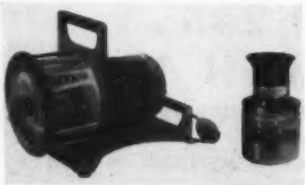

## Mercury Cleaning Units

Five-pound lots of mercury contaminated by dissolved base metals can be reclaimed with a small oxifier for re-use in scientific instruments. Powered by a small electric motor, it violently agitates the mercury for two to four hours to provide maximum air contact with the mercury droplets. Precipitated metallic oxide impurities are readily separated with the Type G filter. Impurities removed include dust, oxide scums, oil, water, and acid residue.

**Bethlehem Apparatus Co, Front and Depot St, Hellertown, Pa.**

•

## Instrument Dial Finish

Metal dials of instruments coated with a new permanently white finish are said to be unaffected by phenol fumes. This problem may be encountered when molded plastic cases are used. The coating is reported to produce a velvet-smooth white finish particularly adapted to printing fine graduations on it. A topcoat of ink-protecting clear finish is available.

**Rexton Finishes, Inc., 62 Woolsey St, Irvington 11, N. J.**

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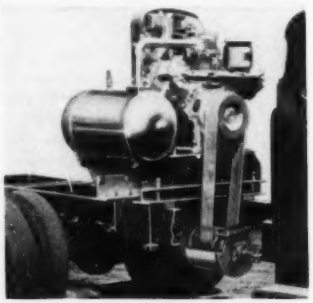


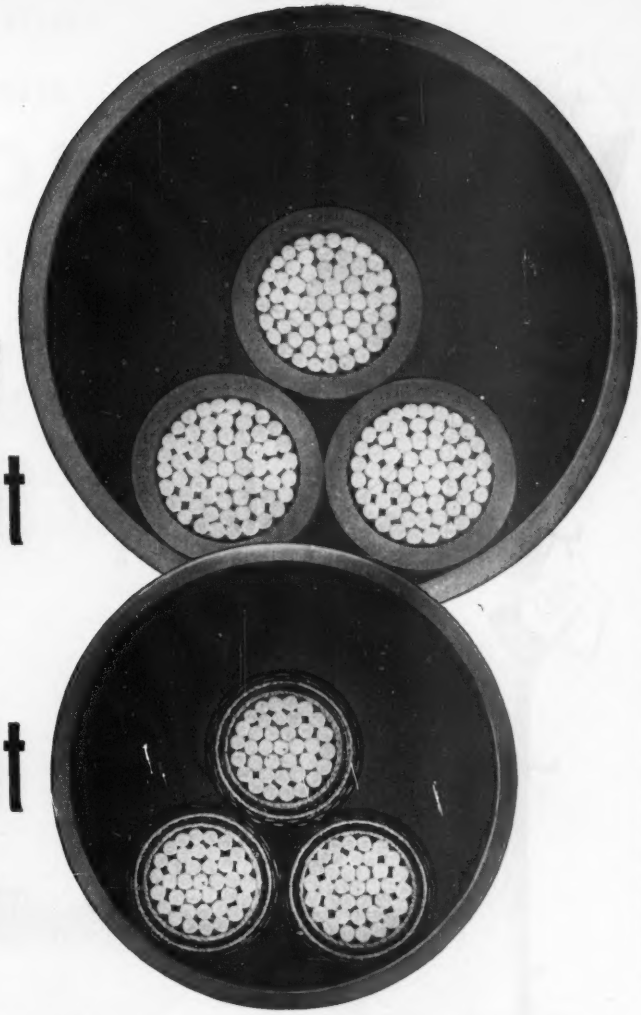
## Truck-Mounted Compressor

Compressed air at 100 psi for driving pavement breakers, clay spades, backfill tampers, and other air tools is supplied by Model 125 compressor. It is intended for truck mounting and truck engine drive. Manufacturer states that unit mounts on any of five makes of 1½ and 2-ton rated trucks, and adapts to special body designs.

Advantages of the unit include: Lower first cost since there is no compressor engine and engine cooling system, fuel tank, and trailer unit; maintenance is reduced since there is no separate engine or trailer tires; truck engine which might otherwise be idle is utilized.

Two heavy duty, or three medium duty, pavement breakers can be operated at full 90 psi at the tools, it

# Why Buy 4" Conduit when 3" Conduit will do?



## INSTALLED COSTS ARE LOWER

### *with high-rated ROCKBESTOS A.V.C.® and a 430 Ampere Load**

- you buy 25% *smaller* conduit
- you use 38% *smaller* cable
- you use *smaller* fittings and lugs
- you have lower labor costs because smaller, lighter cable and conduit are quicker and easier to handle.

To save money specify *permanently-insulated* Rockbestos A.V.C. Write for the booklet "The Story of An Insulation."

*Comparison made with Type RH based on Chapter X, National Electrical Code, 40°C-104°F Ambient

**ROCKBESTOS A.V.C.**

**ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN 4, CONN.**

NEW YORK CLEVELAND DETROIT CHICAGO PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.

Treat your poles right!
Protect them with clean, certain Penta Preservative
Penta-protected poles and cross arms are clean! You'll have lots of praise—and no complaints—from line crews and customers when you specify clean Penta Preservative treatment.
You can absolutely depend on Penta for protection from insect attack and decay. Even after years of service, you'll find no ground line decay, shell rot, top rot, or insect damage in Penta-treated poles and cross-arms.
That's because PENTAcholorophenol is a powerful, stable and uniform wood preservative—allows measured and positive protection. It's always the same! Penetrates deeply into the wood and will not leach out. Doesn't affect conductivity, creates no special problems.
Specify PENTA treatment for safeguarding your poles, cross-arms and other wood construction. It costs no more than other types of preservation. Write us for complete facts and names of companies supplying Penta-treated products.
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CHAPMAN
Penta Preservative
Conforming to A. W. P. A. Specifications P8-49 and P9-49.

is claimed, since 125 cfm of 100 psi air are furnished. Two levers in truck cab control all functions. Truck engine speed is automatically regulated for unloading and compressing. In the illustration, truck frame is cut away to show power takeoff. Much additional information is presented in Bulletin TC-1.

**The Jaeger Machine Co, Columbus 16, Ohio**

•

## Mercury Safety Switch

For safety in hazardous, explosive locations, a mercury switch with either pushbutton or selector knob has been developed. Possibility of a spark is ruled out by manufacturer because the actuating linkage is purely mechanical in nature.

The unit consists of a hermetically-sealed mercury switch mounted on a lever-operated armature. Switch is designed for vertical panel mounting and is a single-pole switch with either double or single throw action. Both pushbutton and selector type knob are shown in photo. Spring in pushbutton model returns switch to position.

**Panalarm Products, Inc, 7212 N. Clark St, Chicago 26, Ill.**

•

## Plastic Laminated Tubing

Glass in the form of cloth, mat or tape has been molded together with various resins to form a laminated tubing, called Glasweld, for use in the construction, electrical, and allied fields. The tubing can be operated continuously at temperatures up to 275 F. Its dielectric constant reportedly varies from 3.6 to 4.0 through a range of one to 10,000 mc, while its loss tangent varies between 0.004 and 0.012 for this range.

There are two types of Glasweld obtainable: (1) Convolute tubing develops equal strength in both longitudinal and circumferential directions, so is recommended for structural pur-

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Victor maintains a modern, fully-equipped ceramic laboratory where fundamental and applied research as well as control tests on raw materials and processing are continually carried on? Small wonder Victor Insulators are famous for performance and economy!

**V ALL METAL PARTS** are hot-dipped galvanized to assure maximum resistance to weathering and corrosion.

**V CONTROLLED TESTING** and **PROCESSING** of cement assure high bond strength at all assembly joints.

**V SMOOTH, HARD GLAZE** assists self-cleaning process, thus reducing maintenance and replacement costs, especially in contaminated areas.

**V SERVICE-TESTED DESIGN** provides for maximum flash-over performance and long leakage distance.

**V HIGHEST QUALITY WET PROCESS PORCELAIN**—"tops" in dielectric and mechanical strength.

**V RUGGED, THICK CORRUGATIONS** and smooth, rounded edges give maximum resistance to impact.

**V RESILIENT COATINGS** at all cemented joints give maximum resistance to thermal variations and mechanical shocks.

**VICTOR NO. 742 (TR-No. 7) SWITCH** and **BUS INSULATOR.** For complete engineering data on this and other sizes and types of switch and bus units, write today for Victor's complete catalog.

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## SWITCH and BUS INSULATORS

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**VICTOR, N. Y.**

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and
Plug it RIGHT
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Johns-Manville
DUXSEAL

Here's the permanently pliable plastic putty for conduit ends, service boxes, cable entrances and drill-holes in foundations. With it, smooth finished looking jobs are quickly made. Duxseal comes in handy-sized packages, so that every electrician can keep it in his tool box for on-the-spot use.

**Remains soft**—Duxseal stays soft indefinitely. Will not slump, melt or run under ordinary temperatures.

**Remains tight**—Clings to duct walls and cables but gives with expansion or contraction of the cable.

**Remains insoluble**—Unaffected by ground waters and gases.

**Remains harmless**—Will not injure workmen's hands or react with rubber, metals or painted surfaces.

**Tight seals for other electrical uses:**

**J-M Tranolseal** . . . for use with electrical equipment using dielectric oils.

**J-M Uniseal** . . . for caulking against weather and humidity. Resists temperatures up to 180 F.

If you would like to know more about Duxseal and other J-M labor-saving sealing compounds, write Johns-Manville, Box 290, New York 16, N. Y. In Canada, write 199 Bay Street, Toronto, Canada.

JM

Johns-Manville
SEALING COMPOUNDS


poses; (2) spiral tubing has a bursting strength twice that of the longitudinal and is suggested for piping applications.

**United States Plywood Corp, 55 W. 44th St, New York 18, N. Y.**

•

## Manual Starter

An indicating light on Motor Sentinel Class 10-023 manual starter shows when the motor is running. Starter is intended for starting and protecting small ac and dc motors used with pumps, compressors, fans, etc. It is available in ratings to 1 hp, 250 v ac or dc, NEMA type I enclosure.

**Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**

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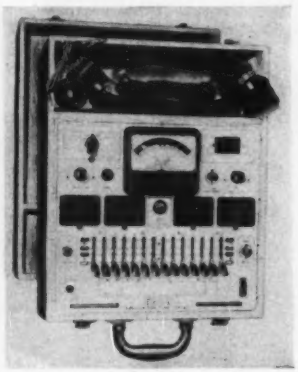

**CATHODE RAY TUBE TESTER—Tests on oscilloscope tubes and industrial cathode ray tubes, as well as special tests for all tube elements, may be performed with Model CR-30 tester. Its test parameters are based on true beam current.**

**Precision Apparatus Co, Inc, 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.**

## MORE NEW PRODUCTS
### about which you should know

Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis., has extended its line of step-type (JFR) **feeder voltage regulators** with a 50-amp, 38.1-kva, 7,620-v unit for use on distribution system laterals. . . . Russell & Stoll Co, Inc, 125 Barclay St, New York, N. Y., is manufacturing new conduit-type Ever-Lok **plugs and connectors** which allow use of any standard size BX connector fittings. Information is in Bulletin CPC-20.

Radiant Lamp Corp, 300 Jelliff Ave, Newark 8, N. J., has added industrial R-60 weatherproof **floodlight lamps** said to eliminate enclosed fixtures; advised where vapors and dust are excessive; 750 and 1,000-w sizes. . . . Livingstone Engineering Co, 100 Grove St, Worcester 5, Mass., has announced Models LP-½ and 400-½ **electric steam boilers.** Output is 20 lb steam per hr; 30 amp, 220 v.

Eaton Mfg Co, Cleveland 10, Ohio, has developed electro-magnetic clutching and **braking devices** actuated by an iron-graphite mixture. . . . Slik Products Co, Manitowoc, Wis., has introduced an **electric paint peeler** using a 200-w, 115-v ac-dc heating element.

The Elwell-Parker Electric Co, Cleveland, Ohio, is building a **power industrial truck** with a hinged platform so that its length may be reduced almost 50%. This allows accommodation in small elevators of older buildings. . . . Buckingham Mfg Co, Inc, Binghamton, N. Y., has a **thread restorer** suited especially for reconditioning closely spaced studs and bolts that are battered or rusted. Sizes cover ASME and SAE standard threads from ¼ in. to 4 in. diam.

The Gallaher Co, 4108 Dodge St, Omaha 3, Neb., is manufacturing the Air-Max **power exhauster** for applications where chief aim is the movement of maximum amounts of dry, uncontaminated air at minimum horsepower. Sizes of the Type C are from 1/20 to 7½ hp. Capacities of the line are from 1,700 to 27,000 cfm inclusive. . . . Radio Corporation of America, 20 Rockefeller Plaza, New York 20, N. Y., has devised the tristimulus **photometer** which simultaneously determines the relative strength of the three basic color components in a light source under study.

Baldwin Locomotive Works, 120 Broadway, New York 5, N. Y., is making the SF-10-U machine as the largest of its line of **fatigue testing machines** which incorporate the constant load principle. . . . The Hart Mfg Co, Hartford, Conn., has an aircraft type, hermetically sealed **relay** built to withstand shocks up to 50 "G's" and temperatures from −65 C to +200 C.

# LITTLE BOOK WINS BIG AUDIENCE!

## . . . will benefit your customers with "Light-Conditioning"

ALREADY, thousands of people who have heard about General Electric's new lighting recipe booklet have requested copies. Offer of the booklet on the Fred Waring Television show, in spot radio commercials and magazine ads has produced many thousands of requests.

"See Your Home in a New Light" is sure-fire! Make the most of its tremendous appeal by using it to promote "Light-Conditioning" in your community. Prepared by General Electric home lighting specialists, the new book covers every major home lighting situation.

22 recipes give detailed information on lighting, such as exact measurements for lamp placement, for every purpose in the home.

General Electric is making the lighting recipe booklet available to electric service companies at nominal cost in any quantity you require for broad distribution. For full information and suggestions on methods of distributing it, call your G-E Lamp District Office. General Electric Company, Lamp Department, Nela Park, Cleveland 12, Ohio.

GENERAL ELECTRIC

# NEWS ABOUT PEOPLE

## Hardy Is President of Ryerson Steel Co

Charles L. Hardy has been elected president and Thomas Z. Hayward vice president of Joseph T. Ryerson, Inc. Hardy succeeds Everett D. Graff

C. L. HARDY

who has been appointed chairman of the executive committee.

Formerly assistant to the president, Hardy joined the Ryerson Boston

T. Z. HAYWARD

plant in 1927 and served in plant operations and sales for 18 years. In 1945 he was made manager of the Philadelphia plant and in 1949 moved to the general offices in Chicago as assistant vice president in procurement, later becoming assistant to the president.

Hayward, who joined Ryerson in 1917, was formerly general sales manager for the company's steel service plants. Practically all of his 33 years with the company have been spent in the sales department.

•

## Ridout Is Named Editor of 'Electricity on the Farm'

W. J. Ridout, Jr, rural service manager of Edison Electric Institute, has been appointed editor of "Electricity on the Farm" magazine. He succeeds the late George W. Kable, who had been editor since 1937.

Ridout's entire career has been in rural electrification. He started with Kentucky & West Virginia Power Co at Pikeville, Ky., as rural service engineer in 1939. Late the next year he became power engineer for East Tennessee Light & Power Co at Bristol.

In 1941 Ridout was named extension agricultural engineer in charge of rural electrification for South Carolina Extension Service at Clemson College. After World War II naval service he took charge of rural electrification for the North Carolina Extension Service at Raleigh. He went to EEI in 1947. He is a member of the United States Department of Agriculture's Research Advisory Committee on Farm Electrification.

•

**Howard C. Fuller** has been named manager of the St. Lawrence district of Niagara Mohawk Power Corp. His headquarters will be located at Potsdam, N. Y. Fuller formerly was power engineer for the utility at Utica. He succeeds **Reginald H. Stratton** who has been appointed executive assistant to Leland D. McCormac, a vice president of the company. Both appointees are veterans in the service of Niagara Mohawk and its predecessors.

**E. D. Chapman** has been appointed manager of the newly created western division of the Ohio Power Co. The division was formed by consolidating the company's northern and Lima divisions.

## Stover Made NYSE&G Chief Electrical Engineer

J. Riley Stover has been appointed chief electrical engineer by the New York State Electric & Gas Corp, and George E. Dana has been named as assistant chief electrical engineer. Stover is succeeding William W. Perry who is retiring after 37 years in the utility field.

Stover entered the utility field in 1922 with the Edison Illuminating Co of Easton, Pa. He became test engineer for the Metropolitan Edison Co,

J. R. STOVER

Reading, Pa., in 1923 and later was transferred to the electrical construction department.

In 1926 he joined the electrical drafting section of the E. M. Gilbert Engineering Corp, consulting engineers at Reading. He was appointed electrical engineer for the Gilbert Co in 1928, assistant transmission and distribution engineer in 1932, and Rochester district engineer in 1936. He became assistant chief electrical engineer at NYSE&G in 1939 and has held that position up to now.

Dana joined the General Electric Co at Schenectady in 1925 and served as a student engineer in the testing department. Subsequently he was appointed engineer of the General Electric automatic station engineering department.

He joined the Metropolitan Edison Co at Reading as relay technician in

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Here at Ryerson we're making an all-out effort to ease your steel-buying problems as much as possible.

No, we can't deliver all the steels you may need. Critical shortages growing out of the international situation prevent that. But what we can do—what we *are* doing is working shoulder-to-shoulder to see that you get every *available* item required as quickly as we can get it to you.

In spite of unbalanced stocks, we still have fairly good overall tonnage on hand. And the services of our experienced specialists may prove highly valuable in determining alternates, when the steels you need aren't readily available.

So for any kind of steel—any time—contact your nearby Ryerson plant. You can be sure we'll do our level best to take care of you.

**PRINCIPAL PRODUCTS**

**CARBON STEEL BARS**—Hot rolled and cold finished
**STRUCTURALS** — Channels, angles, beams, etc.
**PLATES**—Many types including Inland 4-Way Safety Plate
**SHEETS**—Hot and cold rolled, many types and coatings
**TUBING**—Seamless and welded, mechanical and boiler tubes
**ALLOYS**—Hot rolled, cold finished, heat treated
**STAINLESS**—Allegheny bars, plates, sheets, tubes, etc.
**REINFORCING**—Bars and accessories, spirals, wire mesh
**BABBITT**—Glyco bearing metal, also Ryertex plastic bearings
**MACHINERY & TOOLS**—For metal fabrication

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# How Many

## WOULD YOU DESIGN INTO A SINGLE-CIRCUIT UNIT SUBSTATION?

### ONE, TWO, THREE, FOUR...? How many would you use for ready access to controls, meters, relays, control transformers and internal secondary connections?

OF COURSE YOU WOULD ARRANGE the equipment functionally . . . safe for meter reading . . . accessible for inspection and testing. Certainly you would use as few doors as possible and still have all equipment easily accessible.

**Here's how Allis-Chalmers makes all equipment accessible using only two outside doors!**

Equipment is grouped according to its function. Meters, recording instruments, control panel—everything your meter readers and operator will need to examine is located in a safe, dead-front compartment . . . visible after opening the front door!

Current transformers, transformer secondary connections, bus work, internal terminations . . . the "hot side" . . . everything to which your test and maintenance crew will want access is located behind the hinged rear door.

**WHAT DOES THIS ARRANGEMENT MEAN TO YOU?**

1. ***Greater Accessibility.*** Potential Transformers and Control Power Transformers are *drawout* mounted. Only two outside doors . . . one for dead-front control . . . the other for test and maintenance.

2. ***Simplified Testing and Inspection.*** All components are arranged compactly. Hinged doors instead of removable panels mean less fumbling.

3. ***Greater Safety.*** Operator and meter reader have access only to the dead-front controls. Only maintenance and other authorized personnel can get at the "hot" side.

Allis-Chalmers Unit Substations are modern in appearance and can be fitted quickly into your distribution system. For more information about the ruggedly built, functionally arranged Allis-Chalmers SCS Unit Substation that was designed with your requirements in mind, call your A-C sales office or write direct today.

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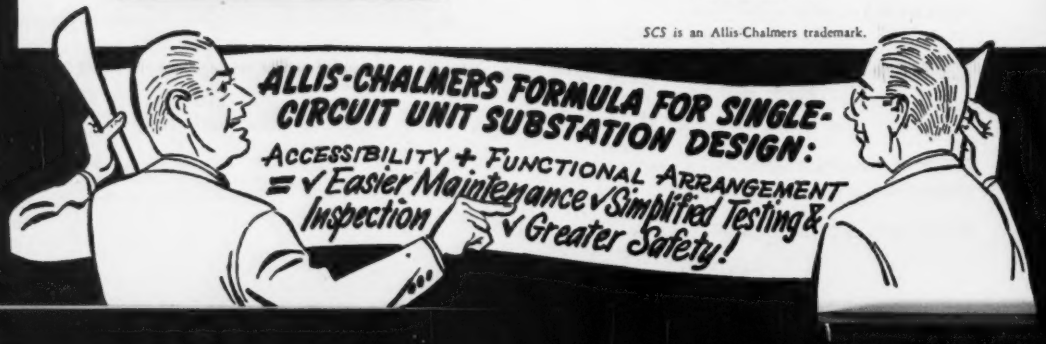
ALLIS-CHALMERS FORMULA FOR SINGLE-CIRCUIT UNIT SUBSTATION DESIGN:
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= ✓Easier Maintenance ✓Simplified Testing &
Inspection ✓Greater Safety!

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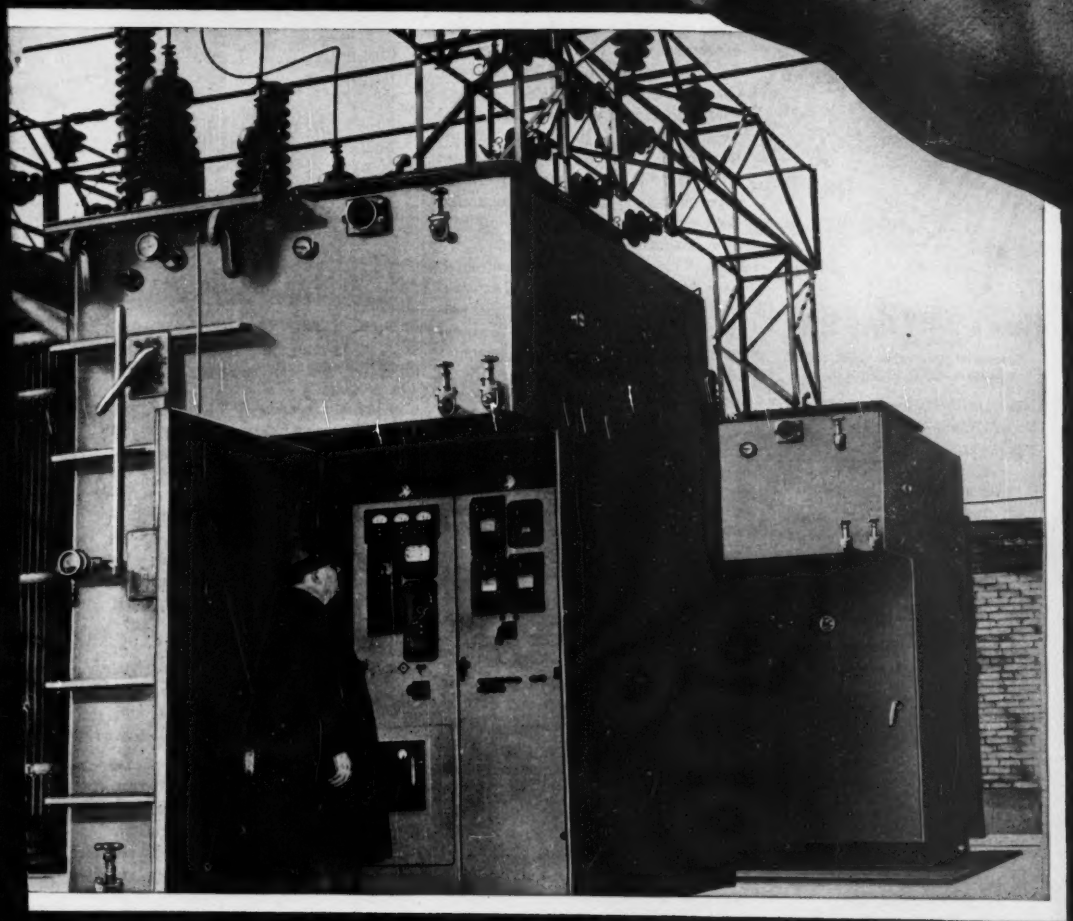
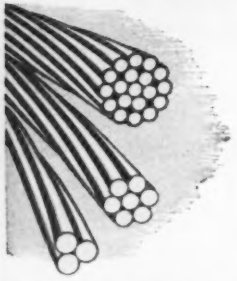
*ONE OF A SERIES:*
IT'S FUNCTIONAL DESIGN THAT COUNTS IN SINGLE CIRCUIT UNIT SUBSTATIONS!



# ALLIS-CHALMERS

***Pioneers in Load Ratio Control — Originators of 5/8% Step Regulation***

PAGE
Stainless Steel
STRAND
and
Stainless-Copper
CONDUCTORS



Here's WHY they Save

Compared with other types strand of equal breaking strength, they . . .

- have 30-40% greater overload capacity within elastic limit
- resist corrosion all the way through —not merely through a thin case of soft metal
- offer highest tensile and vibration-fatigue strength (tensile strength 235,000 psi; corrosion-fatigue limit 50% of ultimate)

Here's HOW they Save

- They permit longer spans—therefore require fewer poles per mile.
- Being lighter, they are easier and faster to install in the field.
- More resistant to destructive factors, they last many times as long before replacement.

Let us tell you the whole story—
specific data, prices, recommended sizes.

ACCO
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PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

1927 and became relay engineer of NYSE&C in 1929 with headquarters at Binghamton.

Perry became an instructor in electrical engineering at Lafayette College in 1911. He later continued his graduate engineering courses at the Westinghouse Electric Corp in Pittsburgh.

He entered the public utility field in 1913 as a junior engineer for the New York Edison Co, following which he joined the Pennsylvania Utilities Co at Easton as a junior engineer. He later became superintendent of substations for this company.

From 1918 to 1924, he served as electrical engineer for the Pennsylvania Edison Co and the New Jersey Power & Light Co. In 1924 he joined the Binghamton Light, Heat & Power Co, predecessor of NYSE&G, as electrical engineer, and was appointed superintendent of operation of the Binghamton division in 1929. From 1932 to 1934 he served as operating superintendent for the Binghamton, Oneonta, Norwich, Walton, and Liberty districts.

In 1935 he became resident engineer for Gilbert Associates, Inc, consulting engineers for NYSE&G construction, and continued in that capacity until his appointment as chief electrical engineer for the utility in 1938. He was made chief engineer in 1940.

•

**Gustav F. Watters,** vice president and director of Niagara Mohawk Power Corp and administrative officer of its western division, will expand his duties on a system-wide basis and transfer his office from Buffalo to Syracuse. Watters has been with Niagara Mohawk since 1935. Following three years as a major in the Army Ordnance Department, he returned to Buffalo as an assistant vice president of Buffalo Niagara Electric Corp and in 1947 was made an executive vice president and director of the Niagara Falls Power Co. Upon the formation of Niagara Mohawk, he was named a vice president and director of the new consolidated operating company.

**Emil R. Schaeffer** has been appointed manager of manufacturing of General Electric Co's switchgear divisions at Philadelphia, Pa. He joined GE in 1919 as a draftsmen in the Philadelphia plant and later became a tool designer, assistant foreman of the tool room, and manufacturing layout supervisor. In 1929 he became supervisor of tool planning and wage rates and ten years later was named works superintendent. From 1948 until his new appointment Schaeffer was assistant manager of manufacturing.

•

## Colorado Utility Names Hyer Vice President

D. B. Hyer, Jr, commercial manager of Florida Power Corp, St. Petersburg, has been elected executive vice

D. B. HYER, JR

president of Southern Colorado Power Co, Pueblo.

Hyer has been with Florida Power since 1927. He held a number of sales and engineering posts, including those of new business supervisor, supervisor of engineering, and assistant superintendent of transmission and distribution before becoming director of industrial development and power sales in 1945 when that department was organized. He was made commercial manager last July.

Hyer is chairman of the Southeastern Electric Exchange's industrial power committee.

•

**George A. Mathews,** inspection and equipment engineer of Detroit Edison Co, has retired after 34 years' service. He began his career in the electric utility business with the Connecticut Lighting Railway Co at Waterbury. He was later assistant superintendent, then superintendent of electric distribution for the Rockland Light & Power Co at Nyack, N. Y. For two years he was with the Western Coal & Mining Co, Jenny Lind, Ark. In 1916 he joined Detroit Edison in the electrical construction field, later went into main-

tenance, and finally into inspection and development. He is responsible for numerous improvements in high-voltage transformers and switchgear and has many inventions to his credit.

**Lee M. Moore** has joined Columbus & Southern Ohio Electric Co as special engineer. He had been employed by the consulting engineering firm of Louis T. Klauber & Associates in Philadelphia and earlier by the Rural Electrification Administration in the technical standards division and by Alabama Power Co.

**Henry L. MacIntire,** senior commercial and industrial representative for the western division of Niagara Mohawk Power Corp, has been named manager of the company's Rome district. He succeeds A. Floyd Wray, who recently was appointed manager of the utility's Niagara Falls district.

## OBITUARY

**Archibald B. Millar,** 68, who retired recently as managing director of the Pennsylvania Electric Association, died Dec. 30 at Harrisburg. He was named managing director of PEA in 1927 and remained in that post until his resignation last Nov. 30. Before going to PEA, Millar served as secretary of the Public Service Commission and also of the Pennsylvania Railroad Commission from which the PSC was organized.

**Hiram Burrell Hardwick,** 52, comptroller and director of Consumers Power Co, died Dec. 28 at Jackson, Mich. He entered the utility field in 1918 with the Alabama Power Co and in 1925 went with Southeastern Power & Light Co, one of the predecessor companies forming the Commonwealth & Southern Corp. Hardwick served as comptroller of Commonwealth & Southern from 1930 to 1947. He was elected comptroller of Consumers Power Co in 1947 and was appointed to the board of directors in 1949.

**John J. Norris,** electrical engineer who helped build one of the first hydroelectric plants in the South, at High Shoals, S. C., died Dec. 26 at Atlanta, Ga. Norris also developed the Portman Shoals hydroelectric plant with William C. Whitner and assisted in the formation of the Southern Power Co.


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# MANUFACTURERS and MARKETS

**ESTABLISHMENT of the Sylvania Television Awards Foundation was announced recently in New York. The "Sylvia," top of a set of awards, will go to the program best illustrating creative TV technique. Sylvania Electric Corp executives shown above are, l to r, Don G. Mitchell, president; M. F. Balcom, chairman of the board; and J. K. McDonough, Radio and Television Division general sales manager**

## Sylvania Offers 'Sylvia' as Oscar for Television

The "Sylvia" is being offered as television's equivalent of the motion picture industry's Oscar.

Sylvania Electric Products, Inc, has established the Sylvania Television Awards Foundation to recognize outstanding TV programs and individuals. The first awards will be made at a dinner next August in recognition of contributions made in the period from Jan 1 to June 30, 1951.

The top award will go to the program deemed best as creative television technique. Other prizes will be given to the writer, producer, director, actor or actress, cameraman, scene designer, lighting expert, and make-up man considered to have made the greatest contribution in each of these departments in the six-month period. Duplicate awards will be made to the network or station and to the sponsor and his advertising agency. Deems Taylor, author, critic, composer, and commentator, will serve as chairman of a committee of judges to be drawn from the TV industry, the field of entertainment, and outside sources.

Television calls for fresh inventiveness and recognition of responsibility to the audience for content and treatment, Don G. Mitchell, Sylvania president, said. "It is to encourage greater progress in such directions that these awards have been established."

•

## Cobalt Allocation to Hit TV, Other Appliances

Cobalt is the first material to be placed under complete company-by-company allocation by the National Production Authority.

NPA also plans to allocate barium carbonate, a scarce chemical also used in making television tubes. It now is needed for radar tubes.

The agency limited all civilian use of cobalt in January to one-third of the consumption in January, 1950. In December 50% of average use in the first six months of 1950 was allowed most civilian cobalt users. The January allocation will be spread to each purchaser in proportion to his use in the first six months of 1950.

NPA officials said production of radio and television sets would be "hit hard" by the order; that refrigerators, washing machines, stoves, and other appliances would be tightly limited; and that the action would probably mean "putting color television on the shelf."

The Radio-Television Manufacturers Association predicted the cobalt allocation, plus shortages of copper, nickel, tubes, and resistors, would force a 25% to 40% drop in set output by April and 50% by midsummer.

The United States and Canada will be supplying 4,250,000 lb of cobalt annually by the end of 1952, "Mining Engineering" magazine estimates. That's about five times this country's present output but only a little more than half the pre-Korean annual rate of consumption in the United States. New sources are being developed near Salmon, Idaho; Fredericktown, Mo.; and Cobalt, Ontario.

•

## Mobilization Shift Forces Cutbacks in Appliances

Materials shortages and other results of the shift to a war economy have forced production cutbacks and some layoffs for a number of appliance makers. A few price boosts also have been made.

Apex Manufacturing Co has laid off about 7% of its working force, 100 workers at Cleveland and 100 at Sandusky, Ohio. The company predicted cutbacks would increase in the coming months.

About 60 workers have lost their jobs at the vacuum cleaner division of General Electric Co. The action was attributed to a shortage of aluminum.

Westinghouse Electric Corp has laid off 350 employees of the Springfield, Mass., appliance division, which makes refrigerator units, vacuum cleaners, milk coolers, and fans. Production is 20% below the December level there and 15% below at Mansfield, Ohio. The company said it foresaw only minor layoffs at Mansfield.

Crosley Division of Avco Manufacturing Co has laid off nearly 1,000 persons during the last month. The plant had been on an overtime basis for several months.

Frigidaire Division of General Motors Corp reported layoff of about 500

temporary employees, approximately 2.2% of the total employed in two Dayton plants.

Meanwhile Hallicrafters Co, Chicago TV and radio manufacturer, boosted prices from $10 to $25 on seven models of its 1951 line and said other increases would follow. Seven new Westinghouse TV models are priced about 6% to 7% higher than 1950 sets. Philco Corp, however, said it would hold appliance prices at about their 1949 levels, and Sylvania Electric Products, Inc, announced price cuts averaging about 5% on most of its television picture tubes.

•

### Alcan, Britain Reach Agreement on Aluminum

A new agreement covering shipments of Canadian aluminum to the United Kingdom has been arranged between the British government and Aluminum Co of Canada, Ltd.

Alcan is committed to ship 150,000 metric tons to Britain in 1951. Commitments have been augmented under this contract, and Britain also is planning to order 200,000 metric tons in 1952 and in 1953. The new agreement provides for a $25-million British loan to Alcan in return for which the company will give the UK a first call on an additional 92,500 metric tons. This will raise the government's first call to 200,000 metric tons a year for 20 years.

## MANUFACTURING BRIEFS

**Television receiver sales** in the Los Angeles area dropped 30% during November compared to October. November sales were 34,367 sets, against 48,989 in October. Total sets in use in the area now number 831,232. The slump was attributed to shortages, the Korean situation, color TV, the 10% excise tax, Regulation W, and lack of ready cash.

**Metal Prices**
**Jan. 8, 1951**

| | |
|---|---|
| COPPER, Conn. V., lb | $ .24½ |
| LEAD, N. Y., lb | .17 |
| ZINC, prime Western, E. St. Louis, lb | .17½ |
| TIN, Straits qual, N. Y., lb | 1.56 |
| ALUMINUM, ingot, base price | .19 |
| NICKEL, base price | .50½ |
| STEEL, billets, Pitts., ton | 56.00 |
| STEEL, scrap, No. 1 heavy, Pitts., ton | 46.50 |


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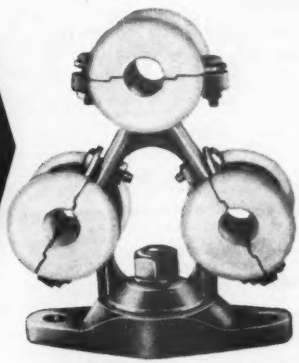

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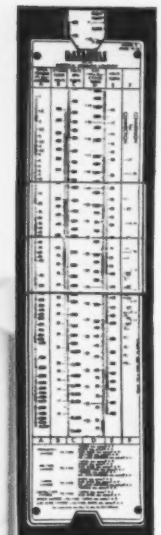

**Making a FREQUENCY CHANGE?**
DATARULE tells number of TURNS required; resistance in OHMS resulting; SIZE OF WIRE needed; what new VOLTAGE can be applied; new IDLE AMPERAGE.

**Making a VOLTAGE CHANGE?**
DATARULE tells number of TURNS required; resistance in OHMS resulting; SIZE OF WIRE needed; proper CONNECTION DATA; change in TORQUE; new IDLE AMPERAGE; size of CAPACITOR.

**Making a TURNS CHANGE?**
DATARULE tells AMPERAGE; resistance in OHMS resulting; SIZE OF WIRE needed; new IDLE AMPERAGE; change in TORQUE.

**Making a CONNECTION CHANGE?**
DATARULE tells number of TURNS required; SIZE OF WIRE needed.

**Making a SPEED CHANGE?**
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## NEW ELECTRICAL CONSTRUCTION

**NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included**

### UTILITIES

#### *Proposed Construction*

**Calif., San Diego**—Dpt. Navy, 1220 Pacific Hy., San Diego, 3 story, rein.-con. electronics laboratory and 2 story addn. **$300,000.** Plans deposit $150.

**Connecticut** — Connecticut Light & Power Co., 36 Pearl St., Hartford, hydroelectric plant, Housatonic River between New Milford and Lake Zoar. **$10,000,000.** Charles T. Main, Inc., 80 Federal St., Boston, Mass., consult. engr.

**Fla., Jacksonville**—City, City Hall, constructing, equipping 3000 kva. sub-station at Arlington suburb of Jacksonville. Reynolds, Smith & Hills, 227 Park St., Zone 1, engrs.

**Idaho**—U. S. Eng., 735 E. Marginal Way, Seattle 4, Wash., three 19,600 hp. hydraulic turbines for Albeni Falls dam, Priest River, Inv. No. CIVENG 51-29.

**Ill., Hutsonville**—Central Illinois Public Service Co., Springfield, steel, brick, concrete power plant. **$10,000,000.** Sargent & Lundy, 140 S. Dearborn St., Chicago, Zone 3, engrs.

**Ia., Marshalltown**—State Bd. Control, E. 12 and Court Sts., Des Moines, plans by Ralph Arnold, 5711 Waterbury Circle, Des Moines, power plant, equip. at Iowa Soldiers Home. **$350,000.**

**Ia., Muscatine**—Northwestern Bell Telephone Co., 604 Ninth St., Des Moines, 2 story, basmt., 82x58 ft. telephone exchange and 1 story, 59x25 ft. office attached steel frame, concrete floors and roof slabs, brick, aluminum panel facing backed up with tile and concrete block $300,000. Morgan-Gelatt & Assocs., 216-24 F & M Bank Bldg., Burlington archts.

**Ia., Pella**—City, power plant bldg. changes, one turbine steam generator with condenser. Approx. $200,000.

**Mass., Salem**—Hytron Radio & Electronic Corp., 76 Lafayette St., mfg. bldg. $150,000.

**Montana and North Dakota**—Bureau Reclamation, Ft. Peck, Mont., construct Glendive-Williston approx 92 mi. 115 kilovolt transmission line, 3 phase, single circuit, woodpole, H frame type with 2 overhead ground wires, Ft. Peck Proj., between Glendive, Mont., and Williston, N. D., Spec. DC 3268.

**Nebraska**—Wayne County Rural Public Power Dist., Wayne, rural distr. lines, Wayne Co. **$350,000.** Henningson Eng. Co., Standard Oil Bldg., Omaha, consult. engr.

**Neb., Hebron**—City, Jack Chapman, mayor, diesel power plant with three dual-fuel engine generator units, ranging in size from 650 to 850 hp., 52x72 ft. brick masonry bldg. 24 ft. high, with attached garage. **$295,000.** Henningson Eng. Co., 626 Standard Oil Bldg., Omaha.

**S. C., Aiken**—South Carolina Electric & Gas Co., 328 Main St., Columbia, electric power plant. **$12,000,000.**

**South Dakota**—West Central Electric Co-operative, Murdo, rural distr. lines, **$3,975,000.** Ulteig Eng. Corp., 1114½ Front St., Fargo, N. D., consult. engrs.

**Texas**—Denton County Electric Co-operative, Denton, 18 mi. rural distr. lines sys. imprvs., 2 way radio sys., Grayson Co. **$160,000.**

**Texas**—Eastex Telephone Co-operative, Lanceville, rebuilding 72 mi. pole lines, and addnl. line rehabilitation, Rusk Co. **$85,000**; 511 mi. new pole telephone lines, Lanceville, Rusk Co. **$250,000.**

**Texas**—Texas Rural Telephone Co-operative, Hereford, 738 mi. pole telephone lines, **$200,000**; storage for equip., **$100,000**, Hereford area, Parmer, Deaf Smith and Castro Counties.

**Tex., Paris**—Westinghouse Electric Corp., Lamp Div., Southland Life Bldg., Dallas, mfg. plant. **$2,250,000.**

**Tex., Richmond**—Southwestern Bell Telephone Co., 1121 Capitol St., Houston, masonry telephone exchange bldg. **$350,000.**

**Tex., Robstown**—City, electric power


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generating unit. **$250,000.** Garrett Eng. Co., 5008 Almeda Rd., Houston, consult. engr.

**Wash., Richland**—General Electric Co., prime contractor, to U. S. Atomic Energy Comm., for operation of Hanford Works, Richland, 2 steel, concrete, 3 steel-frame and 3 frame buildings, 46x80 to 24x36 ft., one story to 70 ft. high; 37x8x5 ft. underground concrete crib and underground 30,000 gal. stainless steel tank at Hanford Works. Extended date. Plans deposit $150.

**Wis., Green Bay**—Wisconsin-Michigan Power Co., 137 W. Mill St., Appleton, steam power plant, **$20,000,000,** incl. equipment.

**Wyoming**—Bureau Reclamation, Dpt. Interior, Cody, Thermopolis-Lovell and Garland-Lovell Transmission Lines, Missouri River Basin Proj., Spec. No. DC-3267.

**Alaska**—Bureau Reclamation, Bldg. 1-A, Denver Federal Center, Denver Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Seattle, one 3,000 kva., self-cooled rating, outdoor package-type substation, incl. one 115,000 volt high-voltage switching structure, one 3-phase 34,400 volt delta power transformer with low-voltage winding providing 12,470 grounded wye/7,200 volts for the Palmer Sub-station, Eklutna Proj., Spec. No. DS-3270.

### *Low Bidders & Contracts Awarded*

**Kans., Parsons**—Jensen & Ridge, 622 E. 3 St., Wichita, Kans. Low Bidder. **$598,299,** rehabilitation of Kansas Ordnance Works, electric sys., plant hospital, etc. U. S. Eng., Davidson Bldg., Kansas City 8, Mo.

**South Dakota**—Orlando Constr. Co., Coleman, Wis. Low Bidder, Schedule 1, 58 mi. Sioux-Falls-Brookings Transmission lines, **$427,826,** est. $417,023, Schedule 3, 69 mi. Armour-Fort Randall-Gavins Point transmission lines, **$509,260,** est. $459,676; Flora Constr. Co., 1717 E. Colfax Ave., Denver, Colo., Low Bidder, Schedule 2, 84 mi. Huron-Armour Transmission lines, **$686,552,** est. $602,706, Schedule 4, 89 mi. Gavins Point-Sioux Falls 115 kva transmission lines, **$737,176,** est. $637,712, Missouri River Basin Proj., Spec. DC-3243. Bureau Reclamation, Dpt. Interior, Huron.

**Tex., Cooper**—Texas Power & Light Co., Interurban Bldg., Dallas, Tex. Own Forces. Approx. **$90,000.** power plant remodeling.

**Tex., Fort Worth**—Texas Electric Service Co., Electric Bldg., Fort Worth, Tex. Force Account. **$600,000** last portion KV line around city.

**Wash., Vancouver**—George H. Buckler, 4235 S. E. 17 St., Portland, Ore. Contract Awarded. **$2,000,000.** Hydrogen peroxide plant on 44 acres of Vancouver shipyard site. Electro-Chemical Co., Buffalo, N. Y. Ansley W. Sawyer, M & T Bldg., Buffalo, N. Y., engr. Awarded Dec. 29.

## INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

### *Proposed Construction*

**Calif., Los Angeles**—City Council, City Council City Hall, civic auditorium and music center, **$35,000,000.**

**Ind., East Chicago**—Youngstown Sheet & Tube Co., Stambaugh Bldg., Youngstown, O., steel mill expansion, battery of 75 coke ovens, blast furnace, exten. ore yard, 4 open hearth furnaces, 8 soaking pits, new slab-heating furnaces, **$90,000,000.**

**Mass., South Boston (Sta. Boston)**—Commonwealth of Mass. Market Auth., A. V. Sullivan, chn., 11 Beacon St., Boston, market, south Bay area bounded by Southampton, Dover and Albany Sts. and main line tracks of New Haven R.R. **$15,000,000.**

**Mich., Trenton**—Chrysler Corp., 341 Massachusetts St., Detroit, V-8 engines plant, **$10,000,000.**

**Mont., Kalispell**—Aluminum & Brass Div. of Harvey Machine Co., Inc., 19200 S. Western St., Torrance, Calif., aluminum plant, **$25,000,000.** CD.

**N. C., Roanoke Rapids**—Albemarie Paper Mfg. Co., Tredegar St., Richmond, Va., plant. **$6,800,000.**

**Pa., Midland**—Crucible Steel Co. of America, Midland, expansion and imprvs., rebuilding 11 O. H. Furnaces, construct blast furnace and 30 coke ovens. **$26,000,000.**


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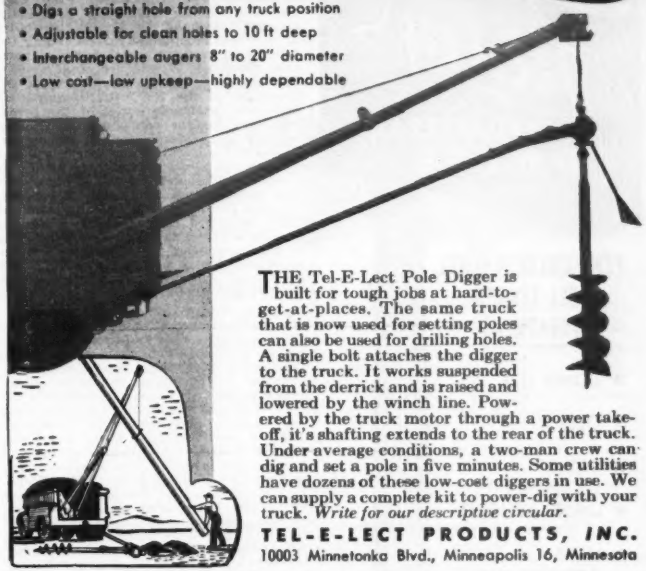

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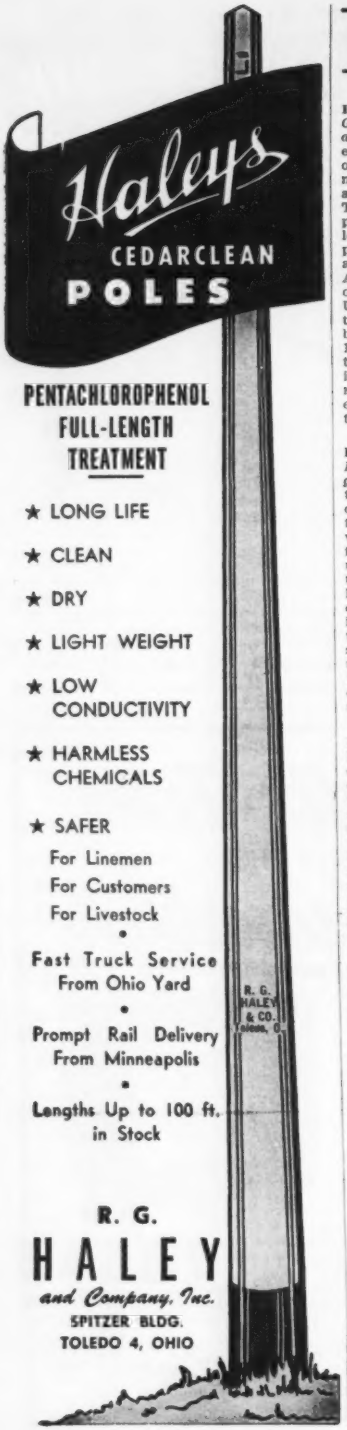


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## TECHNICAL LITERATURE

**Plug Caps** — *American Standard for Grounding-Type Attachment Plug Caps and Receptacles*, C73a-1950, covers the essential elements for interchangeability of caps and receptacles for grounding the noncurrent-carrying metal parts of portable household appliances and devices. The standard was prepared to meet the provision in the NEC that requires at least one receptacle outlet of the three-pole type for the connection of laundry appliances in every dwelling occupancy. A receptacle is called for which will not only receive a cap having three blades (a U-shaped or round grounding blade and two standard, parallel, polarized blades), but also permit insertion of any standard 125-v polarized or nonpolarized parallel two-blade cap. Exact location of the slots in the receptacles is specified, as are dimensions. Copies may be ordered for 25¢ each from American Standards Association, 70 E. 45th St, New York 17, N. Y.

**Human Engineering**—A new *Handbook of Human Engineering Data for Design Engineers* is claimed to be the first systematic treatise on the science of designing mechanical equipment on the basis of detailed studies of human capabilities. It was written by the Tufts College Institute for Applied Experimental Psychology under a Navy contract. Eight broad sections deal with: The human machine and human engineering; the human body; characteristics of vision; factors influencing the efficiency of hearing; skin sensitivity and space orientation; motor responses; factors such as sleep, temperature, etc; and intelligence. Handbook PB 100 814 sells for $5 per copy from Office of Technical Services, U. S. Dept of Commerce, Washington 25, D. C.

**Instrument Transformers**—A profusely illustrated 76-page manual, GET-97A, covers theory of operation and the application of instrument transformers. It has been written for practicing engineers and students engaged in the fields of power generation, transmission, and application where metering and relaying problems can be solved by the correct application of instrument transformers. Basic fundamentals included are accuracy standards, insulation and polarity. There is complete information on potential and current transformers, including operating principles, types and ratings, applications, circuits, fusing, etc. Proper transformer for a specific use can be selected by means of a chart. A bibliography is included. Priced at $1, it may be secured from the Apparatus Dept, General Electric Co, Schenectady 5, N. Y.

**Solar Heating** — Annotated *Bibliography on Domestic and Industrial Applications of Solar Heating* has about 150 references listing most of the important English and foreign papers published on various aspects of solar heating between 1930 and the middle of 1950. Part I includes general and historical articles as well as papers on various industrial applications including use of solar energy for boilers and electric power generation. Part II is devoted to important fields of house heating by the different methods of storing solar heat. Bibliography No. 7 may be purchased for $2 from the Engineering Societies Library, 29 W. 39th St, New York 18, N. Y.

**Aircraft Circuit Interrupting** — Uniform acceptable test methods are defined in *Proposed Test Code for Aircraft Circuit Interrupting Devices (12, 24, and 120-v DC Systems)*. Publication 801 is available free of charge from American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.


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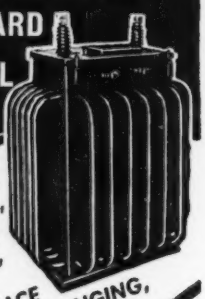

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## CATALOGS • BULLETINS

● AIR SWITCH: Type TW-0 Outdoor group-operated vertical-break air switches are described in Catalog 120. The switches are the rotating-insulator type in ratings of 7.5, 15, and 23 kv, and 400, 600, and 1,200 amp. Pacific Electric Mfg Corp, 5815 Third St, San Francisco 24, Cal.

● POLE HARDWARE: Catalog No. 50 is a reference book on line construction containing a complete listing of pole line hardware and specialties. As far as practical, material is arranged starting with the ground line hardware and proceeding "up the pole." Materials are included for cable, electric railways, street lighting, lightning arresters, and there is a helpful compilation of tables. Hubbard and Co, Pittsburgh 1, Pa.

● LIGHTNING ARRESTERS: First ten pages of "Keystone Expulsion Arresters" cover commercial and semi-technical data. The engineering section, pages 11 to 38, discusses fully the fundamental facts of lightning arrester design. There are many photographs and notes on arrester application. Electric Service Mfg Co, 17th and Cambria Sts, Philadelphia 32, Pa.

● DRY-TYPE TRANSFORMER: Reasons why dry-type transformers are safe and economical to install and maintain in industrial plants, mines, and utilities, are shown in a 23-page booklet, B-4428. Types of air-cooled transformers for every use are illustrated, up to 10,000 kva. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

● HELICOPTERS: "How Utilities Can Profit by Using the Hiller 360" is a pamphlet discussing use of the helicopter in line patrol, trouble-shooting, survey and exploratory work, wire laying, personnel and material transportation, weed and brush clearing, search and rescue, photography and public relations. United Helicopter, Palo Alto, Cal.

● SPEED REDUCERS: Bulletin 3110 describes the all-steel right angle Motoreducer which can be used for either horizontal or vertical applications, single shaft or double ended, from 1 to 50 hp. The Falk Corp, Milwaukee 8, Wis.

● METALS SELECTION CHART: A four-page folder, "Materials Selection Chart", aids in selection of materials most satisfactory for resistance to corrosive media. Carbon steel, copper alloys, etc, are listed for 350 different corrosive conditions. The Cooper Alloy Foundry Co, Hillside 5, N. J.

● FLUORESCENT LIGHTING: The many types of luminaires available, and layout ideas, are given in "New Ideas in Fluorescent Lighting." Lighting Products Inc, Highland Park, Ill.

● RESISTANCE DEVICES: Composition-element and wire-wound controls are among the devices for control and resistance appearing in a new catalog. Clarostat Mfg Co, Inc, Dover, N. H.

● PAINT PRODUCTS: Written for paint-product users in the electrical manufacturing field, public utilities, steel fabricators, and industrial maintenance, a new booklet contains information for application of primers and finishes to transformers, circuit breakers, transmission towers as well as in the structural steel industry. James B. Sipe and Co, Inc, Pittsburgh 16, Pa.

● PRESSURE REGULATION: A 4-page folder gives information about temperature regulators, presure regulators, and desuperheaters. Spence Engineering Co, Inc, Walden, N. Y.


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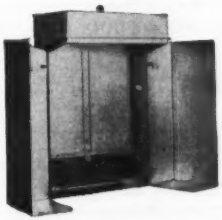

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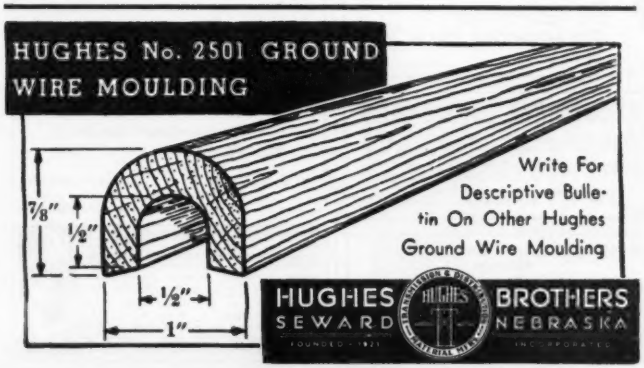

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|---|---|---|---|---|---|
| 1 | 5140 | Whse. | | | |
| 1 | 4000 | G.E. | TSC | 2400/4160 | 900 |
| 1 | 3000 | Whse. | | 2400/4800 | 720 |

### MOTOR GENERATOR SETS

3 ph. 60 cy.

| Qu | KW | Make | Speed | DC Volts | AC Volts |
|---|---|---|---|---|---|
| 2 | 2000 | G.E. | 300 | 600 28 cy | 11000 |
| 1 | 1800 | G.E. | 600 | 125/250 | 2300/4160 |
| 1 | 1500 | G.E. | 360 | 275 | 2300/4600 |
| 1 | 1000 | Whse. | 514 | 250 | 2300 |
| 1 | 1000 | Whse. | 900 | 600 | 4160 |
| 1 | 750 | Whse. | 900 | 275 | 2300/4160 |
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| 1 | 500 | Whse. | 900 | 250 | 440 |
| 1 | 400 | G.E. | 720 | 250 | 440/2300 |

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| | K | Make | Type | Ph | Voltages |
|---|---|---|---|---|---|
| 2 | 2666 | Whse. | OISC | 1 | 66000x11000 |
| 1 | 2500 | Al. Ch. | OISC | 3 | 12300x2300 |
| 3 | 1250 | G.E. | HVDDJ | 1 | 6606x2300 |
| 1 | 1000 | GE | HT | 3 | 12300x2300/4600 |
| 3 | 667 | Whse | OISC | 1 | 66000/34500x2300 |
| 1 | 600 | GE | HT | 3 | 12300x2300/4600 |
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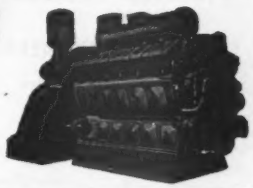

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| 937.5 | General Motors | 12-567 | 1060 | 720 | 312 | Clark | MD-6 | 378 | 257 |
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- 3—500 KVA, Packard, 1 Ph., 2400V, 480V Sec.
- 3—500 KVA Kuhlman, 1 Ph., 4150V, 2300V
- 3—400 KVA G.E., 1 Ph., 6900V, 2300V Sec.
- 3—250 KVA Maloney, 1 Ph., 13,000V, 240/480 Sec
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# LETTERS TO THE EDITOR

## Fault Locators

To the Editor:

On page 20 of the December 25th issue, I noticed under "Technical Notes" this comment by Archer E. Knowlton:

"Inexpensive fault locators would be instrumental in furthering the use of the safest kind of cable in hazardous locations, particularly where fast clearing of faults makes detection of the fault difficult."

We have been manufacturing such a device which is small, portable and yet has enough capacity to locate faults quickly and accurately on all sizes of cable up to 15 kv without any auxiliary detector . . . One of the large electrical utilities in the East has been using this type of device for over 5 years most successfully, and has as many as 11 sets on its system.

This set is not recommended for locating faults on long underground lead-covered cable installed in ducts, which are usually of high voltage, but can be successfully used on all types of cables, as well as for proof testing.

Edward Kerschner
President
The Electrical Distributors Co
Philadelphia, Pa.

## Not for 11 Years

To the Editor:

It will be 11 years (1950-1961) before Christmas Eve and New Years Eve will again occur on Sunday. With the increasing interest in and need for information concerning the load characteristics of the domestic class, the four consecutive Sundays—December 17, 24, and 31, 1950 and January 7, 1951—should provide data that will be extremely valuable in determining the shape of the domestic load curve.

Observations from system load curves and load curves on distribution substations serving residential areas should be particularly illuminating. The street lighting load can be readily and accurately deducted from the system load curves. Commercial and industrial load components, which will be at a minimum, can also be estimated with reasonable accuracy.

Of special interest and value should be a comparison of the load characteristics on December 16 and January 7 with the two Sundays December 24 and December 31 which were the actual holidays.

William S. Leffler
W. S. Leffler Engineers, Inc.
Noroton, Conn.

(Editor's Note:—Electrical World will welcome basic load data of this type together with interpretations.)

## Other Rope Safety Users?

To the Editor:

The front cover of Electrical World, issue of October 9, 1950, carries a picture of a lineman placing protective devices over a conductor on a pole. He is wearing a belt with a rope safety.

I have been under the impression that we were the only company which permits linemen to use rope safeties. Therefore, I am interested in getting in touch with any other company which permits their use.

J. R. Steele
Safety Engineer
Oklahoma Gas and Electric Co
321 N. Harvey St.
Oklahoma City 1, Okla.

(Editor's Note: Will companies using rope safeties identify themselves?)

## Electric Egg Washers

To the Editor:

The article describing an electric egg washer—page 148, Electrical World, Nov 20, 1950—reminds us of a hitherto unsolved inquiry for such equipment for a large egg-mart overseas which handles millions of eggs annually.

We would be pleased to learn more about this egg-washer, and whether this is a commercialized unit made for the trade by a manufacturer.

J. H. A. Zoetmulder
Pettee Engineering Office
Brookline, Mass.

(Editor's Note—The egg washer described is made by the H&P Egg Cleaner Co of Sebastopol, Cal. Prices for the 30-, 50-, and 72-egg sizes are $335, $475, and $700, respectively.)

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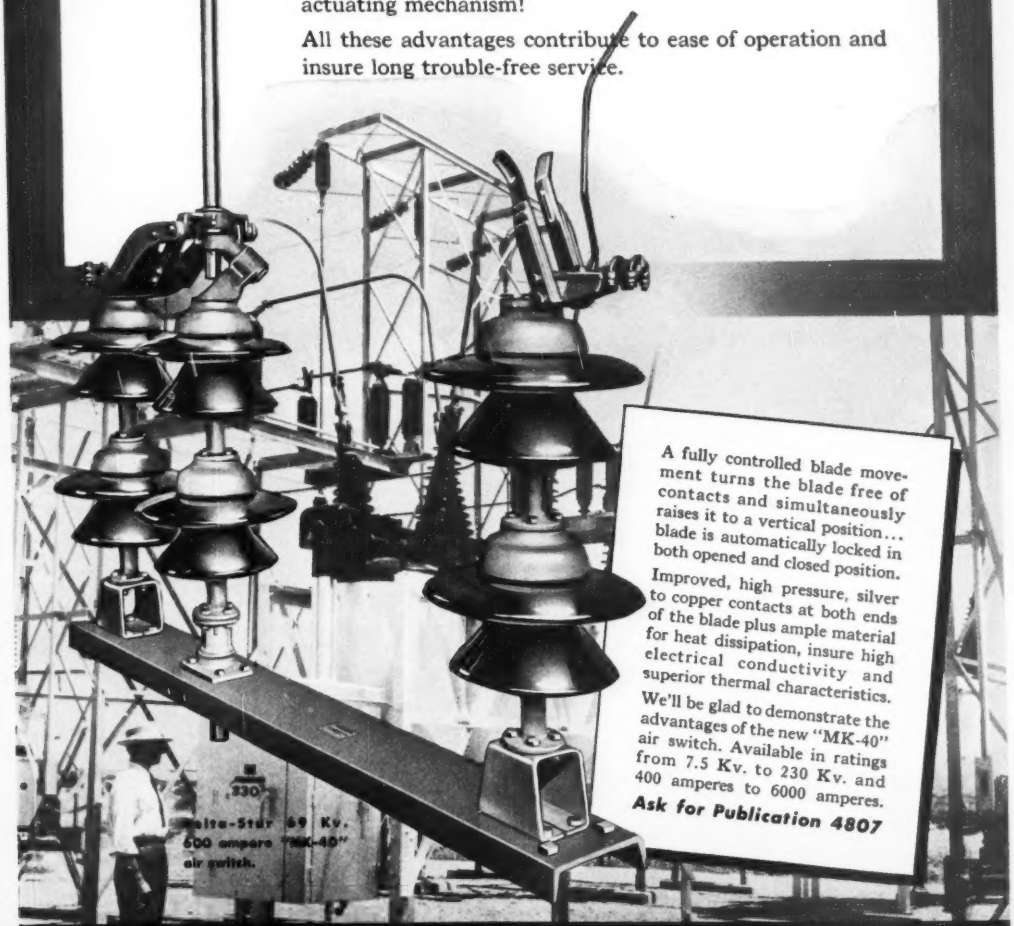
It provides substantial construction! . . . All-around simplicity! . . . Improved contact design! . . . Minimum number of moving parts! . . . Simple and powerful blade actuating mechanism!

All these advantages contribute to ease of operation and insure long trouble-free service.




A fully controlled blade movement turns the blade free of contacts and simultaneously raises it to a vertical position... blade is automatically locked in both opened and closed position.

Improved, high pressure, silver to copper contacts at both ends of the blade plus ample material for heat dissipation, insure high electrical conductivity and superior thermal characteristics.

We'll be glad to demonstrate the advantages of the new "MK-40" air switch. Available in ratings from 7.5 Kv. to 230 Kv. and 400 amperes to 6000 amperes.

***Ask for Publication 4807***

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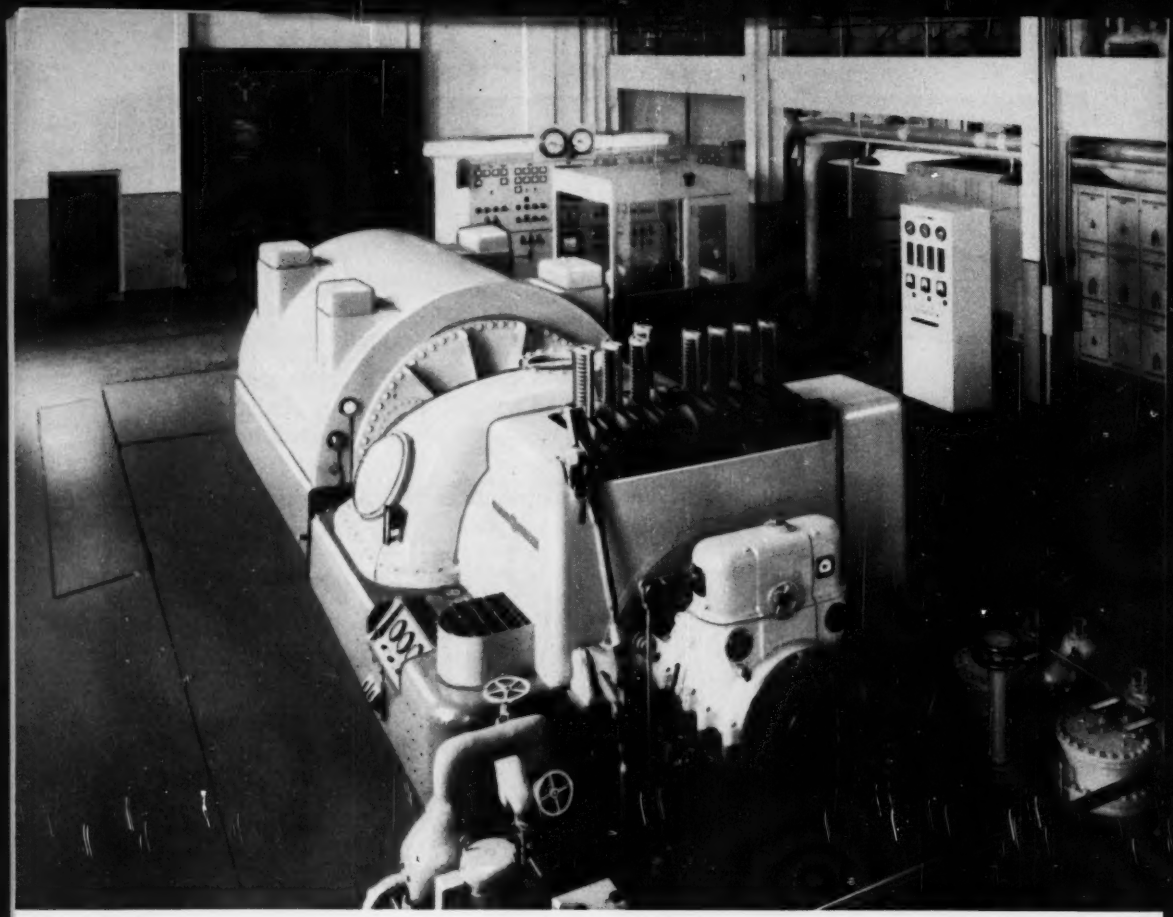

# New turbine is slated for trouble-free life

IN 1949 when this 21,000-KW turbine was put in operation in a midwest power company, officials saw no problem in keeping maintenance at a rock-bottom low. Experience covering 16 years' operation convinced them that they had the answer—NONPAREIL Turbine Oil. They had already put NONPAREIL into three 5,000-KW units—in 1933, in 1935, and in 1940, respectively.

To this day the oil in these units has not been changed, yet there have been no oil-deterioration troubles, no deposit troubles, no high-acidity troubles. In fact oil neutralization numbers have remained below 0.10 mg. KOH/gm.

Consider that record as applied to minimizing your maintenance and costs . . . no oil replacements, no removal of oil for treating, no downtime for cleaning oil systems that stay entirely clean. Moreover, there is no time limit on these benefits. You will receive with each fill of oil a written guarantee that NONPAREIL Turbine Oil will last as long as your turbine, and that its neutralization number will stay below 0.15 mg. KOH/gm.

Have a Standard Oil lubrication specialist show you service records that, in each case, cover 21 years of continuous operation on NONPAREIL Turbine Oil. Ask him for case histories that show how NONPAREIL has reduced utility lubrication costs as much as 68%. You can reach a lubrication specialist through your local Standard Oil Company (Indiana) office. Or, if you wish, write:

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

**NONPAREIL**
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